INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

YEAR XIII - No. 1 JANUARY 1922

ROME
PRINTING OFFICE OF THE INSTITUTE
1922

THE INTERNATIONAL INSTITUTE OF AGRICULTURE

Origin of the Institute and Summary of the International Treaty

The International Institute of Agriculture was established under the International Treaty of 7 June 1905, which was ratified by forty governments. Twenty-two other governments have since adhered to the Institute.

It is a Government institution in which each country is represented by delegates. The Institute is composed of a General Assembly and a Permanent Committee.

The Institute, always confining its attention to the international aspect of the various questions concerned, shall:

(*a*) collect, study and publish as promptly as possible, statistical, technical, or economic information concerning farming, vegetable and animal products, trade in agricultural produce, and the prices prevailing in the various markets;

(*b*) communicate the above information as soon as possible to those interested;

(*c*) indicate the wages paid for farm work;

(*d*) record new diseases of plants which may appear in any part of the world, showing the regions infected, the progress of the diseases, and if possible, any effective remedies:

(*e*) study questions concerning agricultural co-operation, insurance and credit from every point of view; collect and publish information which might prove of value in the various countries for the organization of agricultural co-operation, insurance and credit;

(*f*) submit for the approval of the various governments, if necessary, measures for the protection of the common interests of farmers and for the improvement of their condition, utilizing for this purpose all available sources of information, such as resolutions passed by international or other agricultural congresses and societies, or by scientific and learned bodies, etc.

PERMANENT COMMITTEE

OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

President: His Exc. EDOARDO PANTANO, Senator, *Delegate of Italy.*

Vice-President: M. LOUIS-DOP, *Delegate of France.*

List of the Delegates to the Permanent Committee:

1	ARGENTINA	I	Prof. TOMÁS AMADEO
2	AUSTRIA	IV	. . . . .
3	BELGIUM	IV	P. DE VUYST, Director-General, Ministry of Agricultur
4	BELGIAN CONGO	V	P. DE VUYST.
5	BRAZIL	I	D. DE CAMPOS, Commercial Attaché to the Embassy.
6	BULGARIA	III	G. RADEFF, Minister Plenipotentiary.
7	CHILE	II	E. VILLEGAS, Minister Plenipotentiary.
8	CHINA	I	TCHOU VIN, Secretary to the Legation.
9	COLOMBIA	V	Prince RUFO RUFFO.
10	COSTA-RICA	V	. . . . .
11	CUBA	V	Dr. F. F. FALCO.
12	CZECHOSLOVAKIA	III	. . . . .
13	DENMARK	IV	H. DE KAUFFMANN, Minister Plenipotentiary.
14	ECUADOR	V	. . . . .
15	ETHIOPIA	V	Prof. A. MAURI, Member of Italian Chamber of Deputies.
16	EGYPT	II	Sir THOMAS H. ELLIOTT. Bart., K. C. B.
17	FINLAND	. .	. . . . .
18	FRANCE	I	LOUIS-DOP, Vice-President of the Institute.
19	ALGERIA	III	LOUIS-DOP.
20	FRENCH WEST AFRICA	IV	LOUIS-DOP.
21	INDO-CHINA	V	LOUIS-DOP.
22	MADAGASCAR	V	LOUIS-DOP.
23	MOROCCO	III	LOUIS-DOP.
24	TUNIS	V	LOUIS-DOP.
25	GERMANY	I	Dr. MEHRENS, Councillor of State.
26	GT. BRITAIN & IRELAND	I	Sir THOMAS H. ELLIOTT, Bart., K. C. B.
27	AUSTRALIA	III	Sir THOMAS H. ELLIOTT, Bart., K. C. B.
28	BRITISH INDIA	II	Sir THOMAS H. ELLIOTT, Bart., K. C. B.
29	CANADA	II	Sir THOMAS H. ELLIOTT, Bart., K. C. B.
30	NEW ZEALAND	IV	Sir THOMAS H. ELLIOTT, Bart., K. C. B.
31	UNION OF SOUTH AFR.	IV	Sir THOMAS H. ELLIOTT, Bart., K. C. B.
32	GREECE	IV	D. G. MÉTAXAS, Minister Plenipotentiary.
33	GUATEMALA	V	J. MONTEFIORE, Consul General.
34	HAÏTI	. .	. . . . .
35	HUNGARY	I	. . . . .
36	ITALY	I	His Exc. EDOARDO PANTANO, Senator, Presid. of the Instit
37	ERITREA & IT. SOMALIA	IV	Prof. G. DE MICHELIS, Gen. Commissioner of Emigration.
38	TRIPOLI AND CIRENAICA	IV	Count EDOARDO SODERINI.
39	JAPAN	I	MINORU FUJII, Secretary to the Embassy.
40	LATVIA	V	Dr. M. WALTERS, Minister Plenipotentiary.
41	LUXEMBOURG	V	P. DE VUYST.
42	MEXICO	III	. . . . .
43	MONTENEGRO	V	G. VOLPI, Minister Plenipotentiary.
44	NETHERLANDS	IV	Dr. J. J. L. VAN RIJN, Commercial Attaché to the Legation
45	DUTCH EAST INDIES	IV	Dr. J. J. L. VAN RIJN.
46	NICARAGUA	V	V. E. BIANCHI, Consul General.
47	NORWAY	IV	A. FJELSTAD, Counsellor to the Agricultural Department.
48	OTTOMAN EMPIRE	I	Dr. MEHMED DJÉMIL Bey.
49	PARAGUAY	V	. . . . .
50	PERSIA	V	A. DEL GALLO, Marquis of ROCCAGIOVINE.
51	PERU	V	Prof. E. P. MOLINATTI.
52	POLAND	IV	B. JANISZOWSKI, Consul General.
53	PORTUGAL	IV	EUSEBIO LEÃO, Minister Plenipotentiary.
54	ROUMANIA	I	N. DIANU, Counsellor to the Legation.
55	RUSSIA	I	His Exc. G. ZABIELLO, Consul General.
56	SAN MARINO	V	His Exc. L. LUZZATTI, Minister of State.
57	KINGDOM OF THE SERBS, CROATS AND SLOVENES.	III	C. SCOTTI, Consul General.
58	SPAIN	I	FRANCISCO BILBAO Y SEVILLA, Agricultural Engineer.
59	SWEDEN	IV	Baron C. N. D. DE BILDT, Counsellor to the Legation.
60	SWITZERLAND	IV	GEORGES WAGNIÈRE, Minister Plenipotentiary.
61	UNITED STATES	I	. . . . .
62	URUGUAY	V	ENRIQUE J. ROVIRA, Consul.

Secretary General: Prof. CARLO DRAGONI.

In quoting articles, please mention this REVIEW.

CONTENTS

ABSTRACTS

AGRICULTURAL INTELLIGENCE.

I. — GENERAL INFORMATION.

IENE. — 1. The Effect of a Variation in Milling on the Digestibility of Wheat Flours. — 2. The "Bacteriophagous" Microbe.
ICULTURAL EXPERIMENTATION. — 3. New Institutes for Agricultural Experiment in Italy.
BITIONS, MEETINGS, CONFERENCES. — 4. The International Congress of Household Economy Instruction, Paris, 18-21 April 1922.

II. — CROPS AND CULTIVATION.

a) GENERAL.

CULTURAL METEOROLOGY. — 5. Information concerning the Amazon Region, Brazil. — 5. Influence of Climate on the Fixity of Hybrids from the Standpoint of the Segregation of Characters in the Second Generation.
PHYSICS. — 7. Researches on the Specific Gravity of certain Soil Constituents from the Point of View of the Fineness of the Soil Particles. — 8. Effect of Temperature upon the Absorbent Properties of Soils. — 9. Relation between the Nitrogen Content of the Soil and the Yield of Indigo in India.
HODS OF CULTIVATION. — 10. "Taungya" Cultivation in the Shan States, Burma, and Methods of Soil Treatment recommended.
URES AND MANURING. — 11. Experiments in Liming in the United States and in Canada. — 12. The Present Condition of the Superphosphate Industry in Japan. — 13. Relation of Organic Matter and the Feeding Power of Plants to the Utilisation of Rock Phosphate. — 14. The Effect of Basic Slag upon Grassland and the subsequent Crops. — 15. Results of Manuring with Superphosphate on the Yield and Quality of Indigo in India. — 16. Effect of Phosphate Fertilisers in Conjunction with Green Manures, upon Spring Cereals in India. — 17. Assimilability of Organic Nitrogenous Compounds. — 18. The Influence of Certain Fertiliser Salts on the Growth and Nitrogen Content of some Leguminous Plants. — 19. Carbonication of Plants by Combustion Gases.

b) SPECIAL.

ICULTURAL BOTANY, CHEMISTRY AND PHYSIOLOGY OF PLANTS. — 20. A Systematic Catalogue of the Plants cultivated in Spain (Species and Varieties) and of the Principal Species of Trees. — 21. "Arroz brabo", a Wild Rice in the Interior of Brazil. — 22. Composition of Californian Citrus Fruits. — 23. A Study of Nitrogen and Root Space as Factors limiting the Yield of Maize in Egypt. — 24. Observations on the Growth of Maize in Egypt.
NT BREEDING. — 26. Study of Barley Hybrids, especially from the Standpoint of Fixity of the Segregation of Characters in the F_2. — 27. Studies in Linkage Relations in Maize made in the United States. — 28. Type and Variability in Kafir (*Andropogon Sorghum*). — 29. The Interesting Relation between the Appearance of the Globe Mutant in *Datura*

III. — LIVESTOCK AND BREEDING.

a) GENERAL.

PLANT DISEASES.

PERIODICAL PUBLICATIONS REVIEWED BY THE BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES.

ARGENTINA.

Anales de la Sociedad rural argentina. Buenos Aires.

Anuario de la Dirección general de Estadística. Buenos Aires.

Anuario estadístico. República Argentina. Buenos Aires.

Argentine (The) Year-Book. London.

Boletín mensual del Museo Social Argentino y *Boletín bibliográfico mensual (anexo al Bol. mens. d. Museo Soc. Arg.).* Buenos Aires.

Campo (El). Buenos Aires.

Comercio (El) exterior argentino. Buenos Aires.

Gaceta rural. Buenos Aires.

Industria (La) lechera. Buenos Aires.

Ministerio de Agricultura de la Nación. Dirección general de Enseñanza e Investigaciones agrícolas : 1. *Boletín.* — 2. *Circulares.* — 3. *Publicaciones.* Buenos Aires.

Ministerio de Agricultura de la Nación. — Dirección general de Minas, Geología e Hidrología, Boletín. Serie A : Minas, Serie B : Geología' Serie C : Hidrología y Perforaciones, Serie D : Química mineral y Aguas minerales. Serie F : Informes preliminares y Comunicaciones. Buenos Aires.

Monitor de Sociedades anónimas y Patentes de Invención. Buenos Aires.

Publicación del Museo agrícola de la Sociedad rural argentina. Buenos Aires.

Review (The) of the River Plate. Buenos Aires.

Revista de la Facultad de Agronomía y Veterinaria. La Plata.

Revista del Centro Estudiantes de Agronomía y Veterinaria de la Universidad de Buenos Aires. Buenos Aires.

Revista de Ciencias Económicas. Buenos Aires.

Revista (La) de la Liga agraria. Buenos Aires.

Revista Forestal. Buenos Aires.

Revista de la Sociedad rural de Córdoba. Córdoba.

Universidad de Tucumán : 1) *Extensión agrícola. Boletín.* — 2) *Informe del Departamento de Investigaciones industriales.* Tucumán.

AUSTRALIA.

Agricultural (The) Gazette of New South Wales. Sydney.

Annual Report. Department of Agriculture and Industries of Western Australia. Perth.

Annual Report. Department of Lands and Survey. South Australia. Adelaide.

Annual Report. Papua. Melbourne.

Annual. Royal Agricultural Society of New South Wales. Sydney.

Australian (The) Farm & Home. Melbourne.

Australian Museum. Records. Sydney.

Australian (The) Sugar Journal. Brisbane.

Australian (The) Zoologist. Sydney.

Bulletin of the Department of Agriculture, Western Australia. — Idem : *Division of Botany and Plant Pathology, Entomological Section.* Perth.

Bulletin of the Department of Intelligence, South Australia. Adelaide.
Chemist (The), Druggist and Pharmacist of Australasia. Melbourne.
Fruit (The) World of Australasia. Melbourne.
Government Gazette of Western Australia. Perth.
Institute of Science and Industry. Bulletin. Melbourne.
Journal of the Department of Agriculture of South Australia. Adelaide.
Journal of the Department of Agriculture of Victoria. Melbourne.
Land (The). Sydney.
Motor (The) in Australia. Sydney.
New South Wales. Department of Agriculture: 1. *Farmers' Bulletin.* — 2. *Science Bulletin.* Sydney.
New South Wales (The) Industrial Gazette. Sydney.
Pastoral (The) Review. Melbourne.
Producer's Review. Perth.
Quarterly Summary of Australian Statistics. Melbourne.
Queensland (The) Agricultural Journal. Brisbane.
Queensland. Bureau of Sugar Experiment Stations. Division of Entomology: 1. *Bulletin* — 2. *General Series Bulletin.* Brisbane.
Queensland Government Gazette. Brisbane.
Queensland (The) Industrial Gazette. Brisbane.
Report. Agricultural and Stock Department. Parliament of Tasmania. Hobart.
Science and Industry. Melbourne.
South Australia. Department of Agriculture. Bulletin. Adelaide.
South (The) Australian Government Gazette. Adelaide.
Tasmania Agricultural and Stock Department. Bulletin. Hobart, Tasmania.
Victorian Year Book. Melbourne.
Western Australia Year Book. Perth.
Year Book (The Official) of New South Wales. Sydney.
Year Book (Official) of the Commonwealth of Australia. Melbourne.

AUSTRIA.

Akademie der Wissenschaften. Sitzungen der mathematischen-naturwissenschaftlichen Klasse. Wien.
Allgemeine Wein-Zeitung. Wien.
Amtliche Veterinärnachrichten. Wien.
Berichte aus den neuen Staaten. Wien.
Centralblatt für das gesamte Forstwesen. Wien.
Jahrbuch der geoologischen Reichsanstalt. Wien.
Jahrbuch der Landwirtschaftsgesellschaft in Wien. Wien.
Jahrbuch der österreichischen Industrie. Wien.
Jahresbericht der Samenkontroll-Station in Wien. Wien.
Jahrbücher der zentral-Anstalt für Meteorologie und Geodynamik. Offizielle Publikation. Wien.
Land- und volkswirtschaftliche Mitteilungen. Linz.
Landwirtschaftliche Mitteilungen für Kärnten. Klagenfurt.
Milchwirtschaftliche Zeitung. Wien.
Mitteilungen der deutschen Landwirtschaftsgesellschaft in Brünn. Brünn.
Oesterreichische Fischerei-Zeitung. Wien.
Statistisches Jahrbuch des Ackerbauministeriums. Wien.
Verhandlungen der geologischen Reichsanstalt. Wien.
Wiener allgemeine Forst- und Jagd-Zeitung. Wien.
Wiener landwirtschaftliche Zeitung. Wien.
Zeitschrift des Österr. Ingenieur u. Architekten-Vereines. Wien.
Zeitschrift für das landwirtschaftliche Versuchswesen in Deutschösterreich. Wien.
Zeitschrift für Garten- und Obstbau. Wien.

BELGIUM AND BELGIAN CONGO.

Académie royale de Belgique. Bulletin de la Classe des Sciences. Bruxelles.
Agronomie (L') tropicale. Uccle-lez-Bruxelles.
Annales de Gembloux. Bruxelles.
Annales de l'Observatoire royal de Bruxelles, publiés aux frais de l'Etat et *Annuaire météorologique.* Bruxelles.
Annales de Médecine Vétérinaire. Bruxelles.
Annales des Travaux publics de Belgique. Bruxelles.
Annales du Musée du Congo belge. (Ministère des Colonies). Bruxelles.
Annuaire de la Belgique scientifique, artistique et littéraire. Bruxelles.
Annuaire de l'Institut international de Bibliographie. Bruxelles.
Annuaire officiel. Ministère des Colonies. Bruxelles.

Annuaire statistique de la Belgique et du Congo belge. Bruxelles.
Be gique' horticole, agricole et avicole. Bruxelles.
Belgique (La) maritime et coloniale. Bruxelles.
Bibliographie de Belgique :
Première Partie : Bulletin mensuel des Publications belges ou relatives à la Belgique.
Seconde Partie : Bulletin mensuel des articles de fond parus dans les revues belges. Bruxelles.
Boer (De). Leuwen.
Boerin (De). Leuwen.
Bulletin agricole du Congo Belge. Bruxelles.
Bulletin de Documentation économique. Bruxelles.
Bulletin de la Société centrale forestière de Belgique. Bruxelles.
Bulletin de la Société chimique de Belgique et *Bulletin de la Fédération des Industries chimiques de Belgique.* Bruxelles.
Bulletin de l'Association des Planteurs de Caoutchouc. Anvers.
Bulletin de la Société Royale Linnéenne de Bruxelles. Bruxelles.
Bulletin d'Informations agricoles. Bruxelles.
Bulletin du Jardin Botanique de l'Etat à Bruxelles. Bruxelles.
Bulletin mensuel de la Commission permanente Belge du Lait. Malines.
Bulletin mensuel du Commerce spécial de la Belgique avec les Pays étrangers. Bruxelles.
Bulletin officiel du Congo Belge. Bruxelles.
Chasse et Pêche. Bruxelles.
Congo. — Revue générale de la Colonie belge. Bruxelles.
Défense (La) agricole belge. Bruxelles.
Ingénieur (L') textile. Wesny-Andrimont-lez-Verviers.
Journal de la Société Nationale des Agriculteurs de Belgique. Bruxelles.
Mercuriales (Les) agricoles. Anverse.
Moniteur (Le) horticole belge. Bruxelles.
Progrès (Le) agricole belge. Jodoigne.
Recueil international de Législation coloniale. Bruxelles.
Recueil mensuel de l'Institut International du Commerce. Bruxelles.
Renseignements de l'Office Colonial (Royaumé de Belgique. Ministère des Colonies). Bruxelles.
Revue bibliographique. Bruxelles.
Revue des questions scientifiques. Louvain.
Revue économique internationale. Bruxelles.
Revue générale agronomique. Uccle lez-Bruxelles.
Revue horticole belge. Huy.
Revue générale du Lait. Lierre.
Tablettes Documentaires Municipales. Bruxelles.
Vie (La) internationale. Bruxelles.

BRAZIL.

Annaes da sociedade rural brasileira. São Paulo.
Annuaire du Brésil économique. Rio de Janeiro.
Annuario brasileiro de Agricultura, Industria e Commercio. São Paulo.
Archivos da Escola superior de Agricultura e Medicina Veterinaria. Nichteroy.
Archivos do Museu Nacional do Rio de Janeiro. Rio de Janeiro.
Archivos do Jardin botanico do Rio de Janeiro. Rio de Janeiro.
Boletim da Agricultura. São Paulo.
Boletim da Agricultura, Commercio e Industria. Bahia.
Boletim da Directoria de Industria e Commercio. São Paulo.
Boletim do Instituto agronomico de Campinas. Campinas, S. Paulo.
Boletim do Ministerio da Agricultura, Industria e commercio. Servicio de Informações e Divulgação. Rio de Janeiro.
Boletim do Ministerio de Relações exteriores Rio de Janeiro.
Boletim do Museu commercial do Rio de Janeiro. Rio de Janeiro.
Boletim do Museu Goeldi. Belem (Pará).
Brazil agricola. Rio de Janeiro.
British (The) Chamber of Commerce Monthly Journal. São Paulo.
Chacaras & Quintaes. São Paulo.
Criador (O) Paulista. São Paulo.
Egatea. Revista da Escola de Engenharia de Porto Alegre. Porto Alegre.
Estancia (A). Porto Alegre.
Evolução (A) agricola. São Paulo.
Fazenda (A). Rio de Janeiro.
Fazenda (A) moderna. Rio de Janeiro.
Fazendeiro (O). São Paulo.
Lavoura (A). Rio de Janeiro.
Lavoura e Criação. Rio de Janeiro
Progresso (O). Porto Alegre.
Revista commercial, industrial e agricola do Pará. Belem, Pará.

Revista do Centro de Cultura scientifica. Pelotas, Rio Grande do Sul.
Revista de Commercio e Industria. São Paulo.
Revista de Veterinaria e Zootechnia. Rio de Janeiro.
Rivista (La) coloniale. San Paolo.
Rivista Italia-Brasile. Rio de Janeiro.

British Colonies.

Agricultural (The) Bulletin of the Federated Malay States. Kuala Lumpur.
Agricultural News. Bridgetown, Barbados.
Annals of the R. Botanic Gardens, Peradeniya.
Annual Report. Cyprus. London.
Annual Report. Department of Agriculture. British East Africa. Nairobi.
Annual Report. Department of Agriculture, Fiji. Suva.
British East Africa. Department of Agriculture. Agricultural Bulletin. Nairobi.
British (The) North Borneo Herald, Jesselton.
Bulletin of Agricultural Information, Trinidad. Port-of-Spain.
Bulletin of the Department of Agriculture. Jamaica. Hope, Kingston.
Bulletin of the Dept. of Agriculture. Trinidad and Tobago. Port-of-Spain.
Bulletin of the Direction of Land Records and Agriculture. Colombo.
Ceylon Department of Agriculture : 1. *Leaflet,* Colombo. — 2. *Bulletin,* Peradeniya.
Cyprus (The) Agricultural Journal. Nicosia.
Federated Malay States. Department of Agriculture. Bulletin. Kuala-Lumpur, F. M. S.
Fiji Department of Agriculture. Bulletin. Suva, Fiji.
Fiji (The) Planters' Journal. Suva, Fiji.
Journal (The) of the Board of Agriculture of British Guiana. Demerara.
Journal (The) of the Jamaica Agricultural Society. Kingston.
Nyasaland. Department of Agriculture. Bulletin. Zomba, Nyasaland.
Nyasaland Government Gazette. Zomba.
Report. Department of Agriculture, Trinidad and Tobago. Trinidad.
Rhodesia (The) Agricultural Journal. Salisbury.
Southern Provinces of Nigeria. Agricultural Department. Bulletin. Lagos.
Straits Settlements Government Gazette. Singapore.
Trinidad and Tobago. Board of Agriculture. Circulars. Port-of-Spain, Trinidad.
Tropical Agriculturist & Magazine of the Ceylon Agricultural Society. Peradeniya, Ceylon.
West Indian Bulletin. Bridgetown, Barbados.
West Indies. Imperial Department of Agriculture, Pamphlet Series. Bridgetown.
Zanzibar Government Leaflet. Zanzibar.

Bulgaria.

Annuaire statistique du Royaume de Bulgarie. Sophie.
Годишникъ на Софийскиѧ Университетъ. Sofiia.
Годишенъ Отчетъ на Държавната Земледѣл. Опытна Станция въ Саловъ. Plovdiv.
Земледѣлие. Sofiia.
Земледѣлско-Скотоводство. Sofiia.
Земледѣлско-Метеорологичен Бюлетинъ. Sofiia.
Метеорологически Годишникъ. Саловъ. Sofiia.
Сѣобщения по Земледѣлието. Sofiia.
Трудове на Държавната Земледѣлска *Опытна Станция въ Образцовъ Чифликъ, при Русе.* Varna.
Revue des Instituts de Recherches agronomiques en Bulgarie. Sophie.

Canada.

Agricultural (The) Gazette of Canada. Ottawa.
Agricultural (The) Journal, Department of Agriculture of Victoria. Victoria, B. C.
Annuaire du Canada. Ottawa.
Annual Report. Canadian Seed Growers' Association. Ottawa.
Association canadienne de Producteurs de Semences. Compte rendu de l'Assemblée annuelle. Ottawa.
British Columbia. Department of Agriculture : 1. *Bulletin.* — 2. *Circulars.* Victoria, B. C.
Bulletin de la Société de Géographie de Québec. Québec.
Canadian (The) Entomologist. London, Ont.

Canadian Farm and Agricultural Journal for the Dominion. — *General Issue* — *Market Issue.* Toronto.

Canadian (The) Horticulturist. Peterboro, Ont.

Canadian (The) Horticulturist and Beekeeper. Peterboro, Ont.

Canadian (The) Patent Office Record. Ottawa.

Canadian Poultry News. Grimsby, Ont.

Canadian (The) Power Farmer. Winnipeg.

Canadian Yearbook. Toronto.

Conservation. Ottawa.

Department of Agriculture. Ottawa.
Branch of the Dairy and Cold Storage Commissioner: 1. *Bulletin.* — 2. *Report of the Commissioner.*
Central Experimental Farm. *Bulletin.*
Dominion Experimental Farms: 1. *Bulletin.* — 2. *Exhibition Circulars.* — 3. *Seasonable Hints.* — 4. *Report.*
Fruit Branch: *Telegraphic Report.*
Fruit Commissioner's Branch: *Fruit and Vegetable Crop Report.*
Health of Animals Branch: 1. *Bulletin.* — 2. *Report.*
Tobacco Division: 1. *Bulletin.* — 2. *Report.*

Department of Interior. Ottawa.
Forestry Branch: 1) *Bulletin.* — 2. *Circulars.*

Department of Marine and Fisheries. 1. *Monthly Record of Meteorological Observations.* — 2. *Monthly Weather Review.* Ottawa.

Department of Mines. Ottawa.
Geological Survey. 1. *Museum Bulletin.* — 2. *Report.*
Mines Branch. *Bulletin.*

Department of Trade and Commerce. Ottawa.
Bureau of Statistics: *Monthly Report of the Trade of Canada.*
Commercial Intelligence Branch: *Weekly Bulletin.*
Grain Research Laboratory: *Bulletin.*
Laboratory of the Inland Revenue Department: *Bulletin.*

Farm and Dairy and Rural Home. Toronto, Ont.

Gazette (La) agricole du Canada. Ministère fédéral de l'Agriculture. Ottawa.

Journal (Le) d'Agriculture et d'Horticulture. Montréal.

Manitoba Agricultural College. Bulletin. Winnipeg.

Manitoba Department of Agriculture and Immigration. Manitoba Farmer's Library. Extension Bulletin. Winnipeg.

Ministère de l'Agriculture de la Province de Québec. Circulaires. Québec.

Ministère fédéral de l'Agriculture. Ottawa.
Division du Commissaire de l'Industrie animale: 1. *Bulletin.* — 2. *Rapport.*
Division du Commissaire des Semences: 1. *Bulletin.* — 2. *Rapport.*
Fermes expérimentales du Dominion 1. *Bulletin.* — 2. *Conseils pour la Saison.* — 3. *Rapport.*
Service de l'Entomologie: *Circulaires.*

Ministère des Mines. Commission géologique. 1. *Bulletin du Musée.* — 2. *Rapport.* Ottawa.

Ontario Department of Agriculture: 1. *Ontario Agricultural College. Bulletin.* Guelph, Ont. — 2. *Municipal Bulletin.* Toronto.

Province of Alberta. Department of Agriculture. Provincial Schools of Agriculture. Bulletin. Edmonton.

Province of Alberta. Department of Agriculture. Statistics Branch. Crop Bulletin. Edmonton.

Province of Quebec. Department of Agriculture. 1. *Rapport du Ministre de l'Agriculture.* — 2. *Circulars.* Quebec.

Public (The) Service Monthly. Regina.

Rapport annuel de l'Association canadienne des Producteurs de Semences. Ottawa.

Rapport annuel de la Société de Pomologie et de Culture fruitière de la Prov. de Québec. Québec.

Rapport annuel sur le Commerce du Canada. Ottawa.

Rapport de la Societé d'Industrie laitière et de l'École laitière de la Province de Québec. Québec.

Rapport de la Société de Québec pour la Protection des Plantes contre les Insectes et les Maladies fongueuses. Québec.

Rapport du Ministre de l'Agriculture du Canada. Ottawa.

Revue canadienne. Montréal.

Revue trimestrielle canadienne. Montréal.

Saskatchewan Department of Agriculture. Bulletin. Regina, Sask.

CHILI.

Agricultor (*El*). Santiago.
Anales del Instituto de Ingenieros de Chile. Santiago.
Anuario del Observatorio astronómico nacional de Santiago de Chile. Santiago de Chile.
Anuario estadístico de la República de Chile. Santiago de Chile.
Anuario meteorológico de Chile. Santiago de Chile.
Boletín de la Sociedad agrícola del Norte. Santiago.
Boletín de la Sociedad de Fomento fabril. Santiago.
Boletín del Museo nacional de Chile. Santiago.
Boletín Estadístico. Santiago.
Boletín minero de la Sociedad nacional de Minería. Santiago.
Caliche. Santiago.
Información (*La*). Santiago.
Revista de Bibliografía chilena y extranjera. Santiago.
Revista universitaria. Órgano de los Centros de Estudiantes de la Universidad Católica. Santiago.

CHINA.

Bollettino mensile della Camera di Commercio Italiana per l'Estremo Oriente. Shanghai.
Journal (*The*) *of the Ministry of Agriculture and Commerce*. Peking.

COLOMBIA.

Anuario estadístico. República de Colombia. Bogotá.
Revista agrícola. Bogotá.
Revista nacional de Agricultura. Bogotá.

COSTA RICA.

Anuario estadístico. República de Costa Rica. San José.
Boletín de la Cámara de agricultura de Costa Rica. San José.
Boletín de Fomento. Órgano del Ministerio de Fomento. San José.

CUBA.

Agricultura y Zootecnia. Habana.
Boletín oficial de Marcas y Patentes. — *Secretaría de Agricultura, Comercio y Trabajo*. Habana.
Boletín Oficial de la Secretaría de Agricultura, Comercio y Trabajo. Habana.
Boletín Oficial de la Secretaría de Estado. Memorias comerciales de los Cónsules. Habana.
Estación experimental agronómica : 1. *Boletín*. — 2. *Circulares*. Santiago de las Vegas.
Gaceta Oficial de la Rep. de Cuba. Habana.
Revista de Agricultura, Comercio y Trabajo. Habana.

CZECHO-SLOVAKIA.

Bulletin du Ministère de l'Agriculture de la République Tchécoslovaque. Prague.
Československý Les. Praha.
Československý Zemědělec. Avec les suppléments : *Hospodářské Stroinictví* et *Zemědělské školství a výzkumnictví*. Praha.
Český Včelař. Praha.
Deutsches Agrarblatt. Weinberge bei Prag.
Hospodářský Obzor. Avec le supplément : *Druzstvenictvo*. Bratislava.
Land- und forstwirtschaftliche Mitteilungen. Prag.
Moravský Hospodář. Brno.
Naše Snahy. Praha.
Ovocnické Rozhledy. Praha.
Rol'nik. Trnava.
Sammlung der Gesetze und Verordnungen des čechoslovakischen Staates. Prag.
Sbírka zákonů a nařízení státu československého. Praha.
Sborník zvěrolékařský. Čtvrtletní Příloha Zvěrolékařského Obzoru. Brno.
Slovenská Domovina. Bratislava.
Úradné Noviny. Bratislava.
Venkov. Praha.
Věstník Československé Jednoty Repařů. Praha.
Věstník Ministerstva pro zásobování lidu v Československé republice. Praha.
Věstník Ministerstsva Zěmědelství Československé Republiky. Prag.
Věstník. Příloha Zvěrolékařského Obzoru. Brno.
Zeitschrift für Zuckerindustrie der čechoslovakischen Republik. Prag.
Zemedielie. Praha.
Zěměldelská Politika. Brno.
Zěmědělské a Družstevní Rozhledy. Opava.
Zemědělské Správy. Praha.
Zěmědělský Archiv. Praha.
Zěmědelský Průmysl (supplément au *Československý Zěmědelec*). Praha.
Zvěrolékařský Obzor. Brno.

DENMARK.

Beretning fra den Kgl. Veterinaer- og Landbohøjskoles Laboratorium for Landøkonomiske Forsøg. København.
Beretning fra Forsøgs. laboratoriet utgivet av den Kgl. Veterinaer- og Landohøjskoles Laboratorium for Landøkonomiske Forsøg. København.
Beretning fra Statens Forsøgsvirksomhed i Plantekultur. København.
Beretning fra Statens Planteavlsudvalg. København.
Beretning fra Statsanstalten Dansk Frøkontrol e Beretning fra Statsfrøkontrollen (Dansk Frøkontrol). København.
Beretning om den under Landbrugsministeriet sorterende Landøkonomiske Konsulentwirtsomhed. København.
Beretning om Faelles-Udvalget for Fjerkraeavlens. København.
Beretning om Landboforeningerne. København.
Comptes Rendus des Travaux du Laboratoire de Carlsberg. Copenhague.
Danish (The) Export Review. Copenhagen.
Dansk Patenttidende. København.
Haven. København.
Hedeselskabets Tidsskrift. Viborg.
Landmandsblade. København.
Maelkeritidende. Odensee.
Maanedlige Oversigter over Sygdomme hos Haveplanterne fra Statens plantepatologiske Forsøg. K benhavn.
Maanedlige Oversigter over Sygdomme hos Landbrugets Kulturplanter fra Statens plantepatologiske Forsøg. København.
Meddelelser fra den Kgl. Veterinaer- og Landbohøjskoles Serumlaboratorium. København.
Nordisk Jordbrugsforskning. Grubberholm pr. Vall .
Statistiske Efterretninger. København.
Tidsskrift for Landbrugets Planteavl. København.
Tidsskrift for Landøkonomi. Københavyn.
Tidsskrift for Opmaalings- og Matrikulsvaesen. København.
Udenrigsministeriets Tidsskrift. København.
Ugeskrift for Landmaend. København.
Vort Landbrug. København.

DOMINICAN REPUBLIC.

Revista de Agricultura. Santo Domingo

ECUADOR.

Boletin de Agricultura. Quinta normal. Ambato.
Boletin del Ministerio de Relaciones exteriores. Quito.
Boletin del Laboratorio municipal de Guayaquil. Guayaquil.

EGYPT AND SOUDAN.

Agricultural (The) Journal of Egypt. Cairo.
Annuaire statistique de l'Egypte. Le Caire.
Bulletin Commercial. Alexandrie.
Bulletin de la Société entomologique d'Égypte. Le Caire.
Bulletin de l'Union des Agriculteurs d'Égypte. Le Caire.
Cairo (The) Scientific Journal. Cairo.
Égypte (L') contemporaine. Le Caire.
Mémoires de la Société entomologique d'Égypte. Le Caire.
Ministry of Agriculture, Egyp. Technical and Scientific Service. Bulletin. Cairo.
Monthly Report issued by the Commercial Intelligence Branch, Central Economic Board. Cairo.
Sultanic Agricultural Society. Technical Section. Bulletin. Cairo.

FINLAND.

Årsbok. Afvelsföreningens för Ayrshireboskap i Finland. Lahti.
Årsbok (Statistik) för Finland (Annuaire statistique de Finlande). Helsingfors.
Arsbok, Osterbottens Svenska Landtbrukssällskaps. Vasa.
Finska Mosskulturföreningens Årsbok. Helsingfors.
Maatalouden Hevoshoitolehti. Helsinki.
Maatalouden Karjanhoitolehti. Helsinki.
Maatalous. Helsinki.
Metsätaloûdellinen Aikakauskirja. (Forstlige Tidskrift). Helsingfors.
Pellervo. Helsingfors.

FRANCE.

Acclimatation (L'), Journal des Éleveurs. Paris.
Afrique (L') française. Paris.
Agronomie (L') coloniale, Bulletin mensuel du Jardin colonial, Paris.
Alpes (Les) industrielles. Grenoble.
Annales de Chimie analytique et de Chimie appliquée et Revue de Chimie analytique réunies. Paris.

Annales de Géographie. Paris.
Annales de la Brasserie et de la Distillerie. Paris.
Annales de la Direction de l'Hydraulique et des Améliorations agricoles (*Bulletin*). Paris.
Annales de la Science agronomique française et étrangère, Institut national agronomique. Paris.
Annales de la Société d'Agriculture, Science et Industrie de Lyon. Lyon.
Annales de la Société entomologique de France. Paris.
Annales de l'École nationale d'Agriculture de Grignon. Paris.
Annales de l'École nationale d'Agriculture de Montpellier. Montpellier.
Annales de l'École nationale d'Agriculture de Rennes. Rennes.
Annales de l'Institut colonial de Bordeaux. Renseignements commerciaux et économiques. Bulletin mensuel. Bordeaux.
Annales de l'Institut national agronomique. (*Ministère de l'Agriculture*). Paris.
Annales de l'Institut Pasteur. Paris.
Annales des Falsifications et des Fraudes. Paris.
Annales des Sciences naturelles (*Botanique*). Paris.
Annales. Documents officiels. Statistique. Rapports. Comptes rendus de Missions en France et à l'Étranger. Ministère de l'Agriculture. Direction de l'Agriculture. Paris.
Annales du Bureau Central Météorologique de France. Ministère de l'Instruction publique. Paris.
Annales du Comité central agricole de la Sologne. Orléans.
Annales du Musée colonial de Marseille. Paris.
Annales du Service des Épiphyties. Ministère de l'Agriculture. Paris.
Année scientifique et industrielle. Paris.
Année sociale internationale. Reims.
Annuaire. Association des Chimistes de Sucrerie et de Distillerie de France et des Colonies. Paris.
Annuaire colonial du Matériel et de la Mécanique agricoles. Chambre syndicale des Constructeurs de Machines agricoles de France. Paris.
Annuaire de la Betterave. Valenciennes.
Annuaire de l'Agriculture et des Associations agricoles. Lyon & Paris.
Annuaire des Eaux et Forêts. Paris.
Annuaire du Ministère du Commerce et de l'Industrie. Paris.
Annuaire général de la France et de l'Étranger. Paris.
Annuaire statistique de la France. Paris.
Apiculteur (*L'*). Paris.
Archives de Biologie. Paris.
Archives de Parasitologie. Paris.
Association française pour la destruction du varron. Publications. Paris.
Association italo-française d'expansion économique : 1. *Bulletin*. — 2. *Circulaires*. Paris.
Avenir (*L'*) *textile*. Paris.
Bibliographe (*Le*) *moderne*. Paris.
Bibliographie des Sciences et de l'Industrie. Paris.
Bibliographie scientifique française : Ière Section : *Sciences mathématiques et physiques* ; IIème Sect. : *Sciences naturelles et biologiques*. Paris.
Bois (*Le*). Paris.
Brasserie et Malterie. Nancy.
Brevets d'Invention. Office national de la Propriété industrielle. Paris.
Bulletin de l'Office du Gouvernement général de l'Algérie. Paris.
Bulletin de l'Agence générale des Colonies. Service des Renseignements. Ministère des Colonies. (Ancien *Bulletin de l'Office colonial*). Paris.
Bulletin de la Société des Agriculteurs de France. Paris.
Bulletin de la Société botanique de France. — 1. *Mémoires*. — 2. *Séances*. Paris.
Bulletin de la Société d'Encouragement pour l'Industrie nationale. Paris.
Bulletin de la Société de Géographie commerciale du Havre. Havre.
Bulletin de la Société entomologique de France. Paris.
Bulletin de la Société de Pathologie exotique. Paris.
Bulletin de la Société de Pathologie végétale de France. Paris.
Bulletin de la Société scientifique d'Hygiène alimentaire et d'Alimentation rationnelle de l'Homme. Paris.
Bulletin de la Société des Viticulteurs de France et d'Ampélographie. Paris.
Bulletin de l'Association de Documentation bibliographique, scientifique, industrielle et commerciale. Paris.
Bulletin de l'Association des Chimistes de Sucrerie et de Distillerie de France et des Colonies. Paris.
Bulletin de l'Institut colonial de Marseille : Section des Caoutchoucs — Section des Céréales et Plantes à Fécule. — Section des Matières grasses. Marseille.

Bulletin de l'Institut Pasteur — Revues et Analyses. Paris.
Bulletin des récentes publications françaises. Bibliothèque Nationale. Paris.
Bulletin des Sciences Pharmacologiques. Paris.
Bulletin des Séances de la Société des Sciences de Nancy. Nancy.
Bulletin des Soies et des Soieries. Lyon.
Bulletin du Muséum national d'Histoire naturelle. Paris.
Bulletin hebdomadaire des Campagnes. Paris.
Bulletin mensuel de la Chambre syndicale des Constructeurs de Machines agricoles de France. Paris.
Bulletin mensuel de l'Union des Industries chimiques. Paris.
Bulletin mensuel de l'Office du Protectorat français Tunisie. Paris.
Bulletin mensuel de l'Office international d'Hygiène publique. Paris.
Bulletin mensuel de l'Office de Renseignements agricoles (Ministère de l'Agriculture). Paris.
Bulletin mensuel de la Société nationale d'Acclimatation de France. Paris.
Bulletin mensuel des Renseignements frigorifiques. Paris.
Bulletin mensuel du Commerce, de l'Industrie et de l'Agriculture. Paris.
Bulletin mensuel du Syndicat national du Commerce en Gros des Vins, Cidres, Spiritueux et Liqueurs de France. Paris.
Bull. Off. de la Direction des Recherches Scientifiques et Industrielles et des Inventions. Bellevue près Paris.
Bulletin scientifique et industriel de la Maison Roure-Bertrand Fils. Grasse.
Bulletin trimestriel de la Société Mycologique de France. Paris.
Cahiers (Les) coloniaux. Supplément semi-hebdomadaire. Circulaire (Institut colonial de Marseille). Marseille.
Campagne (La). Paris.
Caoutchouc (Le) et la Gutta-Percha. Paris.
Chimie et Industries. Paris.
Cidrerie (La) française. Paris.
Colonies et Marine. Paris.
Comptes rendus des Séances de l'Académie d'Agriculture de France. Paris.
Comptes rendus hebd. des Séances de l'Académie des Sciences. Paris.
Comptes rendus des Séances de la Société de Biologie. Paris.
Comptes rendus statistiques. Office de statistique d'Alsace et de Lorraine. Strassbourg.
Correspondant (Le). Paris.
Documents statistiques réunis par l'Administration des Douanes sur le Commerce de la France. Paris.
Écho (L') forestier. Paris.
Écho (L') des Mines et de la Métallurgie Paris.
Écho (L') des Textiles. Édition hebdomadaire de *L'Avenir textile.* Paris.
Engrais (L'). Lille.
Expansion (L') coloniale. Marseille.
Expansion (L') économique. Paris.
Farmacia. Revue scientifique et de Défense professionnelle. Lyon.
Feuille (La) vinicole. Bordeaux.
France (La) et le Marché italien. Paris.
France (La) Paysanne. Paris.
Gazette (La) coloniale. Paris.
Génie (Le) civil. Paris.
Génie (Le) rural. La Motoculture et l'Électroculture. Paris.
Géographie (La). Bulletin de la Société de Géographie. Paris.
Illustration (L') économique et financière. Paris.
Industrie (L') chimique. Paris.
Industrie (L') française de la Conserve. Paris.
Industrie (L') laitière. Paris.
Informateur (L') Paris.
Information (L') universelle. Paris.
Insecta. Revue illustrée d'Entomologie. Rennes.
Inventions (Les) illustrées. Paris.
Journal agricole d'Alsace et de Lorraine. Strassbourg.
Journal d'Agriculture pratique. Paris.
Journal d'Agriculture pratique, de Viticulture et d'Économie rurale pour le Midi de la France. Toulouse
Journal de la Société Nationale d'Horticulture de France. Paris.
Journal des Économistes. Paris.
Journal des Fabricants de Sucre. Paris.
Journal de Pharmacie et de Chimie. Paris.
Journal officiel de la République française. Paris.
Lait (Le). Lyon.
Matières (Les) grasses. Paris.
Miscellanea entomologica. Uzès.
Monde (Le) industriel, commercial et agricole. Paris.
Moniteur scientifique. Paris.
Moniteur (Le) vinicole. Paris.
Nature (La). Paris.

Néoculture (*La*). Paris.
Nouveaux (*Les*) *Livres scientifiques et industriels*. Paris.
Nouvelle (*La*) *France agricole*. Paris.
Océanie (*L'*) *française*. Paris.
Parfumerie (*La*) *moderne*. Lyon.
Petite (*La*) *Revue agricole et horticole*. Antibes.
Phosphate (*Le*) *et les Engrais chimiques. Revue internationale des Engrais et Produits chimiques*. Paris.
Polybiblion. Revue bibliographique Universelle. 1. *Partie littéraire*. — 2. *Partie technique*. Paris.
Producteur (*Le*). Paris.
Produire. Usinage et Outillage modernes. Paris.
Progrès (*Le*) *agricole*. Amiens.
Progrès (*Le*) *agricole et viticole*. Montpellier.
Rapports commerciaux des Agents diplomatiques et consulaires de France. Paris.
Recueil de Médecine Vétérinaire. Alfort.
Réforme (*La*) *sociale*. Paris.
Renseignements coloniaux et documents publiés par le Comité de l'Afrique française et le Comité du Maroc. Supplément de l'Afrique française. Paris.
Revue agricole, viticole, horticole. Bordeaux.
Revue (*La*) *avicole*. Paris.
Revue de Botanique appliquée et d'agriculture coloniale. — Bulletin du Laboratoire d'Agronomie coloniale. Paris.
Revue (*La*) *de Chimie industrielle*. Paris.
Revue (*La*) *de la Filature et du Tissage*. Paris.
Revue des Eaux et des Forêts. Paris.
Revue de Viticulture. Paris.
Revue d'Histoire naturelle appliquée : Première Partie : *Mammalogie – Aquiculture – Entomologie – Botanique – Colonisation*. — Deuxième Partie : *L'Oiseau*. Paris.
Revue de Zoologie agricole et appliquée. Bordeaux.
Revue (*La*) *du Ciel*. Bourges, Cher.
Revue (*La*) *économique du Centre et de l'Ouest*. Tours.
Revue économique française. Société de Géographie commerciale de Paris. Paris.
Revue française d'Ornithologie. Paris.
Revue générale de Botanique. Paris.
Revue (*La*) *générale du froid et des industries frigorifiques*. Paris.
Revue horticole. Paris.
Revue internationale de Génétique. Nages, Tarn.
Revue (*La*) *de Produits chimiques*. Paris.
Révue (*La*) *scientifique*. Paris.
Revue vétérinaire. Toulouse.
Revue de Zootechnie. Paris.
Science (*La*) *sociale suivant la Méthode d'Observation*. Paris.
Sucrerie, Distillerie, Industries agricoles. Paris.
Technique (*La*) *moderne*. Paris.
Vie (*La*) *agricole et rurale*. Paris.
Vie (*La*) *aux Champs*. Paris.
Vie (*La*) *technique et industrielle*. Paris.

GERMANY.

Allgemeine Fischerei Zeitung. München.
Allgemeine Forst- und Jagd-Zeitung Frankfurt a. M.
Annales Mycologici. Berlin.
Archiv für exakte Wirtschaftsforschung. Thünen Arkiv. Jena.
Archiv für Sozialwissenschaft und Sozialpolitik. Tübingen.
Bericht der Lehranstalt für Wein- Obst- und Gartenbau zu Geisenheim a. Rh. Berlin.
Bericht der Oberhessischen Gesellschaft für Natur- und Heilkunde zu Giessen. Giessen.
Berichte aus dem physiologischen Laboratorium und der Versuchsanstalt des landwirtschaftlichen Instituts der Universität Halle. Hannover.
Berichte über die gesamte Physiologie und experimentelle Pharmakologie. Berlin.
Bericht über das Auftreten von Feinden und Krankheiten der Kulturpflanzen in der Rheinprovinz. Bonn.
Berliner tierärztliche Wochenschrift. Berlin.
Biedermann's Zentralblatt für Agrikulturchemie und rationellen Landwirtschaftsbetrieb. Leipzig.
Biochemische Zeitschrift. Berlin.
Biologische Anstalt für Land- und Forstwirtschaft: 1. *Berichte*. — 2. *Mitteilungen*. — 3. *Flugblatt*. Berlin.
Blätter für Zuckerrübenbau. Berlin.
Botanisches Centralblatt. Jena.
Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie. Leipzig.

Butter- (Der) und Fettwarenverkehr. (Vormals *Berliner Markthallen-Zeitung*). Berlin.
Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten. Erste Abteilung: Originale. Referate. — Zweite Abteilung: Originale, Referate. Jena.
Centralblatt für die Zuckerindustrie. Magdeburg.
Chemiker Zeitung. Cöthen.
Chemisches Zentralblatt. Berlin.
Collegium. Frankfurt a. M.
Deutsche entomologische Zeitschrift «Iris». Dresden.
Deutsche (Die) Essigindustrie. Berlin.
Deutsche landw. Geflügel-Zeitung. Berlin.
Deutsche landw. Presse. Berlin.
Deutsche landw. Tierzucht. Hannover.
Deutsche Rundschau. Berlin.
Deutsche Schlacht- und Viehof-Zeitung. Berlin.
Deutsche Wirtschafts-Zeitung. Zentralblatt für Handel, Industrie und Verkehr. Berlin.
Deutsche (Die) Zuckerindustrie. Berlin.
Deutscher Aussenhandel. Zeitschrift des Handelvertragsvereins. Berlin.
Deutsches Kolonialblatt. Berlin.
Deutsches meteorologisches Jahrbuch. Berlin, Karlsruhe, Bremen, Darmstadt, Stuttgart.
Deutsches meteorologisches Jahrbuch für Bayern. München.
Dinglers polytechnisches Journal. Berlin.
Entomologische Zeitschrift mit Fauna exotica. Frankfurt.
Ernährung (Die) der Pflanze. Stassfurt.
Fischerei-Zeitung. Neudamm.
Forstwissenschaftl. Centralblatt. Berlin.
Fühling's landwirtschaftliche Zeitung. Stuttgart.
Futter- (Die) und Düngemittel Industrie. Magdeburg.
Geisenheimer Mitteilungen über Obst- und Gartenbau. Wiesbaden.
Geographisches Jahrbuch. Gotha.
Geologisches Zentralblatt. Leipzig.
Geographische Zeitschrift. Leipzig.
Gordian. Zeitschrift für Kakao, Zucker und deren Erzeugnisse. Hamburg.
Gummi-Zeitung. Berlin.
Hedwigia. Dresden.
Illustrierte landw. Zeitung. Berlin.
Internationale Bibliographie der Zeitschriftenliteratur: 1. Abteilung A. *Bibliographie der deut. Zeitschriften-Literatur.* — 2. Abt. C. *Bibl. der Rezensionen und Referate.* — 3. *Beilage.* Gautsch bei Leipzig.
Internationale Mitteilungen für Bodenkunde. Berlin.
Jahrbuch der deutschen Bibliotheken. Leipzig.
Jahrbuch der deutschen Landwirtschafts-Gesellschaft. Berlin.
Jahrbuch der Moorkunde. Bericht über die Fortschritte auf allen Gebieten der Moorkultur und Torfverwertung. Hannover.
Jahrbuch der Versuchs- und Lehranstalt für Brauerei in Berlin. Berlin.
Jahrbuch des Instituts für Jagdkunde (Neudamm und Berlin-Zehlendorf) gegründet von der deutschen Jäger-Zeitung. Neudamm.
Jahrbücher für Nationalökonomie und Statistik mit Beilage. Jena.
Jahrbuch für wissenschaftliche und praktische Tierzucht einschliesslich der Züchtungsbiologie. Hannover.
Jahrbuch über neuere Erfahrungen auf dem Gebiete der Weidewirtschaft und des Futterbaues. Hannover.
Jahresbericht der agrikulturchemischen Versuchsstation Berlin. Breslau.
Jahresbericht der landw. Hochschule in Berlin. Berlin.
Jahresbericht der Vereinigung für angewandte Botanik. Berlin.
Jahresbericht des Instituts für Zuckerindustrie. Berlin.
Jahresbericht. Institut für angewandte Botanik. Hamburgische botanische Staatsinstitute. Hamburg.
Jahresbericht über das Gebiet der Pflanzenkrankheiten. Berlin.
Jahresbericht über die Erfahrungen und Fortschritte auf dem Gesamtgebiete der Landwirtschaft. Braunschweig.
Jahresbericht über die Ergebnisse der Immunitätsforschung. Stuttgart.
Jahresbericht über die Fortschritte auf dem Gesamtgebiete der Agrikulturchemie. Berlin.
Jahresbericht über die Fortschritte, Veröffentlichungen und wichtigeren Ereignisse im Gebiete des Forst-Jagd- und Fischereiwesens. Frankfurt a. Main.
Jahresbericht über die Untersuchungen und Fortschritte auf dem Gesamtgebiete der Zuckerfabrikation. Braunschweig.
Just's botanischer Jahresbericht. Leipzig.
Jahrbücher für wissenschaftliche Botanik. Leipzig.

Kaiser Wilhelm Institut für Landwirtschaft in Bromberg: 1. *Mitteilungen.* Berlin. — 2. *Abteilung für Pflanzenkrankheiten. Berichte.*

Kazett. Kakao und Zuckerwaren Industrie Fachblatt. Dresden.

Kolloid-Zeitschrift (Zeitschrift für wissenschaftliche und technische Kolloidchemie). Leipzig.

Kolonial Rundschau. Berlin.

Kölnische Volkszeitung und Handels-Blatt. Köln.

Kühn-Archiv. Arbeiten aus dem landwirtschaftlichen Institut der Universität Halle. Berlin.

Kunstdünger-, Futtermittel- und Leim-Zeitung und Oel- und Fett-Zeitung. Berlin.

Land (Das). Berlin.

Landmaschine (Die). Berlin-Charlottenburg.

Landwirtschaftliche Jahrbücher. Berlin.

Landwirtschaftliche Maschinen und Geräte. Artern, Prov. Sachsen.

Landwirtschaftliche Wochenschrift für die Provinz Sachsen. Halle a. S.

Landwirtschaftlichen (Die) Versuchs-Stationen. Berlin.

Mikrokosmos. Stuttgart.

Milchviehkontrollverein (Der). Insterburg.

Ministerialblatt der Preussischen Verwaltung für Landwirtschaft, Domänen und Forsten. Berlin.

Mitteilungen der deutschen Landwirtschafts-Gesellschaft. Berlin.

Mitteilungen der Vereinigung deutscher Schweinezüchter. Berlin.

Mitteilungen des Fischerei-Vereins für die Provinz Brandenburg, Ostpreussen, Pommern. Berlin.

Mitteilungen des Vereins zur Förderung der Moorkultur im deutschen Reiche. Berlin.

Molkerei-Zeitung. Hildesheim.

Monatshefte für praktische Tierheilkunde. Stuttgart.

Nachrichtenblatt für den deutschen Pflanzenschutzdienst. Berlin-Dahlem.

Naturwissenschaften (Die). Berlin.

Naturwissenschaftliche Wochenschrift. Jena.

Notizblätter des botanischen Gartens und Museums zu Dahlem bei Steglitz. Steglitz, Berlin.

Petermanns (Dr. A.) Mitt. aus J. Perthes' geogr. Anstalt. Gotha.

Rheinische Monatsschrift für Obst-, Garten- und Gemüsebau. Bonn.

Süddeutsche landwirtschaftliche Tierzucht. München.

Technische (Das) Blatt. Illustrierte Beilage der Frankfurter Zeitung. Frankfurt a. M.

Technische Rundschau. Wochenschrift des Berliner Tageblatts. Berlin.

Technik für Alle. Technische Monatshefte. Stuttgart.

Technik und Wirtschaft. Berlin.

Tharandter forstliches Jahrbuch. Tharandt.

Tropenpflanzer (Der). — Beihefte zum Tropenpflanzer. Berlin.

Wasserkraft (Die). Zeitschrift für die gesamte Wasserwirtschaft. München.

Wasser und Abwasser. Zeitschrift für die gesamte Wasserwirtschaft, für Wassertechnik und Wasserrecht. Leipzig.

Weinbau und Weinhandel. Mainz.

Wein und Rebe. Mainz.

Weltwirtschaftliches Archiv. Jena.

Wirtschaftsdienst. Hamburg.

Wochenschrift für Brauerei. Berlin.

Wöchentliches Verzeichnis der erschienenen und der vorbereiteten Neuigkeiten des deutschen Buchhandels. Börsenverein d. deutschen Buchhändler zu Leipzig. Leipzig.

Zeitschrift des Vereins der deutschen Zuckerindustrie. Berlin.

Zeitschrift des Vereins deutscher Ingenieure. Berlin.

Zeitschrift für angewandte Chemie mit den wirtschaftlichen Teil: Die Chemische Industrie. Leipzig.

Zeitschrift für angewandte Entomologie. Berlin.

Zeitschrift für Botanik. Jena.

Zeitschrift für Fleisch- und Milchhygiene. Berlin.

Zeitschrift für Forst- und Jagdwesen. Berlin.

Zeitschrift für die gesamte Kälte-Industrie. München.

Zeitschrift für Gestütkunde und Pferdezucht. Hannover.

Zeitschrift für induktive Abstammungs- und Vererbungslehre. Berlin.

Zeitschrift für Infektionskrankheiten, parasitäre Krankheiten und Hygiene der Haustiere. Berlin.

Zeitschrift für Instrumentenkunde. Berlin.

Zeitschrift für das ländliche Fortbildungschulwesen in Preussen. Berlin.

Zeitschrift für Pflanzenkrankheiten. Stuttgart.

Zeitschrift für Pflanzenzüchtung. Berlin.

Zeitschrift für technische Biologie. Berlin.

Zeitschrift für die Spiritusindustrie. Berlin.
Zeitschrift für Untersuchung der Nahrungs- und Genussmittel sowie der Gebrauchsgegenstände. Münster i. W.
Zeitschrift für wissenschaftliche Insektenbiologie. Berlin-Schöneberg.
Zeitschrift für Ziegenzucht. Hannover.
Zentralblatt für die gesamte Landwirtschaft. Berlin.
Zentralblatt für die Kunstdünger-Industrie. Mannheim.
Zentralblatt der Preussischen Landwirtschaftskammern. Berlin.

GREAT BRITAIN AND IRELAND.

Accounts relating to the Trade and Commerce of Certain Foreign Countries and British Possessions. London.
Accounts relating to Trade and Navigation of the United Kingdom. London.
Agricultural and Horticultural Association. One and All Garden Books. London.
Agricultural Organisation Society and its Aims. Leaflets. Dublin.
American Machinist (European edition). London.
Analyst (The). London.
Anglo-Canadian Year-Book. London.
Annals (The) of Applied Biology. London.
Annals of Botany. London.
Annals of Tropical Medicine and Parasitology. Liverpool.
Annual Report by the Chief Veterinary Officer. Board of Agriculture and Fisheries. London.
Armstrong College. Agricultural Department. College Bulletin. Newcastle-upon-Tyne.
Asiatic (The) Review. London.
Baltic (The) Review. London.
Biometrika. Cambridge.
Bird Notes and News. London.
Bloodstock Breeders' Review. London.
Board of Agriculture for Scotland. — 1. *Scottish Journal of Agriculture.* — 2. *Monthly Agricultural Report.* — 3. *Leaflets.* Edinburgh.
Board (The) of Trade Journal and Commercial Gazette. London.
Bodleian (The) Quarterly Record. Oxford.
British (The) Bee Journal and Beekeepers Adviser. London.
British Birds. London.
British (The) Year Book of Agriculture and Agricultural Who's Who. London.
Bulletin of Entomological Research. London.
Bulletin of the Imperial Institute of the United Kingdom, Colonies & India. London.
Bulletin of Miscellaneous Information. R. Botanic Gardens Kew. London.
Chamber (The) of Commerce Journal. London.
Chemical (The) News. London.
Chemical (The) Trade Journal and Chemical Engineer. London.
Cold Storage and Produce Review. London.
Colonial (The) Journal. London.
Cooperative Reference Library, Miscellaneous Publications. Dublin.
Dairy (The) World & British Dairy Farmer. London.
Department of Agriculture and Technical Instruction for Ireland. Journal of the Department of Agriculture and Technical Instruction for Ireland. Dublin.
Economist (The). London.
Engineer (The). London.
Engineering. London.
Entomologist's (The) Monthly Magazine. London.
Estate (The) Magazine. Letchworth, Herts.
Eugenics (The) Review. London.
Farmer (The) and Stock Breeder and Chamber of Agriculture Journal. London.
Farmer's (The) Journal. Belfast.
Field (The). London.
Fishing (The) Gazette. London.
Forestry Commission Leaflet. London.
Fruit Grower, Fruiterer, Florist and Market Gardener. London.
Fuel Economy Review. London.
Gardeners' Chronicle. London.
Geographical (The) Journal. London.
Herefordshire County Council. Farmers' Bulletin. Hereford.
Ice and Cold Storage. London.
Illustrated (The) Official Journal (Patents). London.
Implement (The) and Machinery Review. London.
India Rubber (The) Journal. London.
Institute (The) of Chemistry of Great Britain and Ireland. Proceedings. London.
International Sugar Journal. Altringham.

Irish Agricultural Organisation Society. Leaflets. Dublin.
Irish Gardening. Dublin.
Journal of Agricultural Science. Cambridge.
Journal (The) of Botany, British and Foreign. London.
Journal (The) of Ecology. Cambridge.
Journal (The) of Genetics. Cambridge.
Journal (The) of State Medicine. London.
Journal of the Central and Associated Chambers of Agriculture and Agricultural Record. London.
Journal of the Chemical Society. London
Journal of the Farmers' Club. London.
Journal of the Institute of Bankers. London.
Journal of the Institute of Brewing. London.
Journal (The) of the Land Agents' Society. London.
Journal of the Manchester Geographical Society. Manchester.
Journal of the Ministry of Agriculture. London.
Journal of the Royal Horticultural Society. London.
Journal of the Royal Society of Arts. London.
Journal of the Society of Chemical Industry. London.
Journal (The) of the Textile Institute. Manchester.
Journal of Tropical Medicine and Hygiene. London.
Live Stock Journal. London
London (The) Gazette. London.
Mark Lane Express. Agricultural Journal. London.
Memoirs and Proceedings of the Manchester Literary and Philosophical Society. Manchester.
Midland (The) Agricultural and Dairy College. Bulletin. Kingston-on-Soar.
Ministry of Agriculture and Fisheries : 1. *Journal of the Ministry of Agriculture.* — 2. *Monthly Agricultural Report.* — 3. *Leaflets.* — 4. *Monthly Weather Report of the Meteorological Office.* — 5. *The Meteorological Magazine* — 6 *Ministry of Agriculture and Fisheries Handbook. Diseases of Animals Acts.* London.
Monthly Circular of New Publications. H. M. Stationery Office. London.
Monthly List of Official Publications issued by H. M. Stationery Office. London.
Monthly List of Parliamentary Publications issued by H. M. Stationery Office. London.
National (The) Poultry Journal. London.
Naturalist (The). London.
Nature. London.
New (The) Phytologist: a British Botanical Journal. London.
North British Agriculturist. Edinburgh.
Palmer's Index to the Times Newspaper. Shepperton-on-Thames.
Parasitology. Cambridge.
Perfumery (The) and Essential Oil Record. London.
Practical (The) Engineer. London.
Proceedings of the R. Agricultural Society of England. London.
Proceedings of the R. Society of Edinburgh. Edinburgh.
Publishers' Circular and Booksellers' Record. London.
Quarterly Journal of Forestry. London.
Quarterly Journal of Microscopical Science. London.
Quarterly Journal of the R. Meteorological Society. London.
Quarterly List of Official Publications. Issued by H. M. Stationery Office. London.
Quarterly List of Parliamentary Publications. Issued by H. M. Stationery Office. London.
Quarterly Summary and Meteorological Readings. Royal Botanic Society of London. London.
Report. The British Cotton Growing Association. Manchester.
Review (The) of Applied Entomology ; Series A : *Agricultural ;* Series B : *Medical and Veterinary.* London.
Royal Dublin Society : 1. *The Economic Proceedings.* — 2. *The Scientific Proceedings.* Dublin.
Royal Society. 1. *Philosophical Transactions.* — 2. *Proceedings of the R. Society. Biological Science.* London.
Royal (The) Society for the Protection of Birds. Report. London.
Rubber Age. London.
Russian Information and Review. London.
Science Abstracts : Section A : *Physics ;* Section B : *Electrical Engineering.* London.
Science Progress in the 20th Century. London.
Scottish (The) Farmer. Glasgow.
Scottish (The) Geographical Magazine. Edinburgh.

South (The) American Journal and Brazil and River Plate Mail. London.
System. The Magazine of Business. London.
Textile (The) Recorder. Manchester.
Times (The). — *Educational Supplement* — *Engineering Supplement.* — *Imperial and Foreign Trade Supplement* — *Literary Supplement* — *Weekly Edition.* London.
Transactions of the R. Scottish Arboricultural Society. Edinburgh.
Transactions of the Surveyors' Institution. London.
Tropical Life. London.
Tropical Veterinary Bulletin. London.
United Empire, The Royal Colonial Institute Journal. London.
University College of North Wales. Agricultural Department. Publications. Bangor.
University of Cambridge. School of Forestry. Bulletin. Cambridge.
University of Leeds and the Yorkshire Council for Agricultural Education. Publications. Leeds.
University of London. County Councils of Kent and Surrey. Leaflets of the South Eastern Agricultural College, Wye, Kent. London.
Utility Poultry Journal. Newport, Salop.
Wine Trade Review. London.
Yearbook and Register. The National Utility Poultry. London.
Yearbook (The) of the Scientific and Learned Societies of Great Britain and Ireland : A Record of the Work done in Science, Literature and Art. London.

GREECE.

Annales de l'Observatoire national d'Athènes. Athènes.
Γεωργικον και Δασικον Δελτιον. Αθήναι.
Δελτιον Γεωργικον της Γεωργικης Εταιρειας. Αθήναι.
Economiste (L') d'Athènes. Athènes.
Νεα (Τα) Γεωπονικα. Μηνιαιον Γεωργικον Περιοδικον. Αθήναι.

GUATEMALA.

Boletin de Agricultura, Industria y Comercio de Guatemala. Guatemala.
Boletin Oficial de la Secretaria de Fomento. Guatemala.
Centro-América. Guatemala.

HONDURAS.

Revista económica. Tegucicalpa.

HUNGARY.

Danube (Le) International. Budapest.
Ungarische Jahrbücher. Berlin.

INDIA.

Agricultural (An) Journal of the Department of Agriculture, Behar and Orissa. Patna.
Agricultural Journal of India. Calcutta.
Agricultural Research Institute, Pusa. Indigo Publication. Pusa.
Bengal Department of Agriculture : 1 *Departmental Records.* — 2. *Director of Land Records and Agriculture, Bulletin, Agricultural Series.* Calcutta.
Bulletin of the Agricultural Research Institute, Pusa. Pusa.
Bulletin of Land Records and Agriculture. Assam. Shillong.
Bulletin of the Economics Department of the University of Allahabad. Allahabad.
Burma Department of Agriculture : 1. *Bulletin.* Rangoon, Burma. — 2. *Cultivator's Leaflet.* Mandalay, Burma.
Central Provinces. Agricultural Department. Bulletin. Nagpur, C. P.
Department of Agriculture : 1 *Bulletin.* — 2. *Leaflets.* Bombay.
Department of Agriculture Mysore State, General Series Bulletin. Bangalore.
Forest Bulletin. Department of Revenue and Agriculture. Calcutta.
Fruit Experiment Station. Bulletin. Quetta.
Indian and Eastern Engineer. Calcutta.
Indian Engineering. Calcutta.
Indian (The) Forester. Allahabad.
Indian (The) Forest Records. Dehra Dun.
Indian Journal of Economics. Allahabad.
Indian Tea Association Scientific Department. Quarterly Journal. Cinnamara, Assam.
Indian Trade Journal. Calcutta.
Industrial India. Bombay & Calcutta.
Journal (The) of Dairying and Dairy Farming in India. Quetta.
Journal (The) of Indian Botany. Madras.
Journal of Indian Industries and Labour. Calcutta.
Journal of the Indian Economic Society. Bombay.

Madras. Central Agricultural Committee. Bulletin. Madras.

Madras Department of Agriculture: 1. *Bulletin.* — 2. *Leaflets.* Madras.

Madras (The) Forest College Magazine. Coimbatore, South India.

Memoirs of the Department of Agriculture in India. — Bacteriological Series — Botanical Series — Chemical Series — Entomological Series — Veterinary Series. Pusa, Bihar.

Monthly Accounts relating to the Sea-Borne Trade Navigation of British India. Calcutta.

Monthly Statistics of Cotton Spinning and Weaving in Indian Mills. Calcutta.

Monthly Weather Review. Calcutta.

Mysore State Department of Agriculture. Bulletin. 1. *Chemical Series.* — 2. *Entomological Series.* — 3. *Mycological Series.* Bangalore, Mysore.

Planter's (The) Chronicle. Bangalore.

Punjab Department of Agriculture, Bulletin. Lahore, Punjab.

Records of the Botanical Survey of India. Calcutta.

United Provinces of Agra and Oudh. Department of Land Records and Agriculture: Bulletin. Agricultural Series. Allahabad.

Wealth (The) of India. Madras.

ITALY AND COLONIES.

Africa (L') italiana. Bollettino della Società africana d'Italia. Napoli.

Agricoltore (L') del Lazio e dell'Umbria. Roma.

Agricoltura (L') coloniale. Firenze

Agricoltura (L') subalpina. Cuneo.

Agricoltura (L') toscana. Firenze.

Allevamenti. Palermo.

Alpe (L'). Rivista forestale italiana. Firenze.

Annali del Commercio. Ministero di Agricoltura, Industria e Commercio. Roma.

Annali del Consiglio superiore delle acque pubbliche. Ministero dei Lavori pubblici. Roma.

Annali del Laboratorio chimico centrale delle Gabelle. Roma.

Annali della R. Accademia d'Agricoltura di Torino. Torino.

Annali della R. Stazione chimico-agraria sperimentale di Roma. Roma.

Annali della Società degli Ingegneri e degli Architetti Italiani. Roma.

Annali dell'Industria e del Commercio. Ministero di Agricoltura, Industria e Commercio. Roma.

Annali (Nuovi) del Ministero per l'Agricoltura. Roma.

Annali del Museo civico. di Storia naturale di Genova. Genova.

Annali del R. Istituto superiore forestale nazionale. Firenze.

Annali del R. Laboratorio autonomo di Chimica agraria di Forlì. Forlì.

Annali dell'Ufficio agrario provinciale di Bologna and *Annali dell'Ufficio provinciale di Agricoltura di Bologna.* Bologna.

Annali dell'Ufficio centrale meteorologico e geodinamico italiano. Ministero di Agricoltura, Industria e Commercio. Roma.

Annali di Botanica. Roma.

Annali di Chimica applicata. Roma.

Annali d'Igiene. Roma.

Annali d'Ingegneria e d'Architettura. Roma.

Annali di Statistica. Direzione generale della Statistica e del Lavoro. Roma.

Annuario agrario. Bologna.

Annuario bibliografico italiano delle Scienze mediche ed affini. Roma.

Annuario della R. Accademia dei Lincei. Roma.

Annuario della R. Stazione bacologica di Padova. Padova.

Annuario della R. Stazione sperimentale di Caseificio di Lodi. Lodi.

Annuario della Stazione sperimentale di Risicoltura di Vercelli. Vercelli.

Annuario del R. Istituto d'Incoraggiamento di Napoli. Napoli.

Annuario dell'industria cotoniera in Italia. Milano.

Annuario dell'Istituzione agraria Dottor Andrea Ponti. Milano.

Annuario d'Italia and *Annuario generale d'Italia.* Genova.

Annuario per le industri chimiche e farmaceutiche. Ministero per l'Industria, il Commercio e il Lavoro. Roma.

Annuario. R. Stazione chimico-agraria di Torino. Torino.

Annuario scientifico ed industriale. Milano.

Annuario statistico dell'industria bacologica e serica. Ministero per l'Industria, il Commercio e il Lavoro. Roma.

Annuario statistico italiano. Direzione generale della Statistica e del Lavoro. Roma.
Apicoltore (L') moderno. Torino.
Apicoltura (L') italiana e L'apicoltore. Ancona.
Archivio di Scienze Biologiche. Napoli.
Archivio di storia della scienza. Roma.
Atti del Comitato nazionale scientifico. tecnico per lo sviluppo e l'incremento dell' industria italiana. Milano.
Atti della R. Accademia economico-agraria dei Georgofili. Firenze.
Atti della R. Accademia dei Lincei. Rendiconti della Classe di Scienze fisiche, matematiche e naturali. Roma.
Atti dell'Istituto Botanico dell'Università di Pavia. Milano.
Bassa Corte. Genova.
Bollettino agrario. Gorizia.
Bollettino bibliografico delle pubblicazioni italiane. Roma.
Bollettino degli oli e dei grassi. Milano.
Bollettino del Consiglio provinciale d'agricoltura, dei Consorzi agrari e dell'Istituto provinciale di San Michele. Trento.
Bollettino della Biblioteca. Ministeri per l'Agricoltura, per l'Industria e per il Lavoro e la Previdenza sociale. Roma.
Bollettino della Camera agrumaria. Messina.
Bollettino della « Cotoniera ». Milano.
Bollettino della Camera di Commercio e industria – Trieste. Trieste.
Bollettino della Federazione Mineraria italiana. Roma.
Bollettino della proprietà intellettuale. Roma.
Bollettino della Società geologica italiana. Roma.
Bollettino della Società lombarda per la pesca e l'acquicoltura. Milano.
Bollettino dell'Associazione dell'industria laniera italiana. Biella.
Bollettino dell'Associazione italiana delle industrie dello zucchero e dell'alcool. Bologna.
Bollettino dell'Associazione pro piante medicinali ed altre utili. Milano.
Bollettino dell'Unione delle Cattedre ambulanti di Agricoltura italiane. Roma.
Bollettino delle opere moderne straniere acquistate dalle Biblioteche governative del Regno d'Italia. Roma.
Bollettino delle sedute dell'Accademia Gioenia di Scienze naturali. Catania.
Bollettino del R. Comitato geologico d'Italia. Roma.
Bollettino del R. Orto botanico di Palermo. Palermo.
Bollettino di informazioni dell'Ufficio economico del Ministero delle Colonie. Roma.
Bollettino di legislazione e statistica doganale e commerciale. Roma.
Bollettino di notizie commerciali. Roma.
Bollettino di sericoltura. Milano.
Bollettino di studi ed informazioni del R. Giardino coloniale di Palermo. Palermo.
Bollettino mensile di informazioni e notizie della R. Stazione di Patologia vegetale e R. Osservatorio fitopatologico per la Provincia di Roma e degli Abruzzi. Roma.
Bollettino scientifico-tecnico. Milano.
Bollettino tecnico pubblicato per cura del R. Istituto scientifico sperimentale del tabacco. Scafati (Salerno).
Bollettino ufficiale del Governo della Cirenaica. Bengasi.
Bollettino ufficiale del Governo della Tripolitania. Tripoli.
Bollettino ufficiale della Direzione generale Approvigionamenti e Consumi. Roma.
Bollettino ufficiale della Direzione generale del Demanio. Ministero delle Finanze. Roma.
Bollettino ufficiale del Ministero delle Colonie. Roma.
Bollettino ufficiale del Ministero dei Lavori Pubblici. Roma.
Bollettino veterinario italiano. Torino.
Bollettino dell'agricoltura. Milano.
Bollettino della R. Società toscana di Orticoltura. Firenze.
Bollettino della Società botanica italiana. Firenze.
Camera di Commercio ed Industria, Brescia. Processi verbali di sedute. Brescia.
Camera di Commercio e Industria, Udine. Adunanze. Udine.
Camera di Commercio e di Industria, Venezia. Sedute pubbliche. Venezia.
Circeo (Il). Roma.
Caseificio (Il) moderno. Roma.
Clinica (La) veterinaria. Milano.
Coltivatore (Il). Casalmonferrato.
Contadino (Il) della Marca Trevisana. Treviso.
Cronaca agricola. Torino.
Diana. Il « Field d'Italia ». Firenze.
Eco (L') degli ingegneri e periti agrimensori. Pescia.
Economia (L') rurale. Torino.
Esportazione (L'). Milano.

Forestale (*Il*). Roma.
Forno (*Il*) *elettrico*. Roma.
Gazzetta agraria, commerciale e industriale. Alessandria.
Gazzetta chimica italiana. Roma.
Gazzetta ufficiale del Regno d'Italia. Roma.
Geografia (*La*). Novara.
Giornale (*Il*) *agrario*. Bologna.
Giornale degli allevatori. Catania.
Giornale degli economisti e Rivista di statistica. Roma
Giornale del Genio civile. Roma.
Giornale della libreria, della tipografia e delle arti e industrie affini. Milano.
Giornale di agricoltura della domenica. Piacenza.
Giornale di chimica industriale ed applicata. Milano.
Giornale di geologia pratica. Parma.
Giornale d'ippologia. Pisa.
Giornale d'Italia agricolo. Roma.
Giornale d'Italia forestale. Roma.
Giornale di medicina veterinaria della R. Società nazionale e Accademia veterinaria italiana. Torino.
Giornale (*Il*) *di risicoltura*. Vercelli.
Giornale vinicolo italiano. Casalmonferrato.
Illustrazione (*L'*) *coloniale*. Milano.
Industria (*L'*). Milano.
Industria (*L'*) *alimentare italiana*. Napoli.
Industria (*L'*) *del legno*. Milano.
Industria (*L'*) *lattiera e zootecnica*. Reggio Emilia.
Industrie (*Le*) *italiane illustrate*. Milano.
Informazioni seriche. Roma.
Ingegneria (*L'*) *italiana*. Roma.
Italia (*L'*) *agricola*. Piacenza.
Italia (*L'*) *vinicola ed agraria*. Casalmonferrato.
Laboratorio di studi ed esperienze sulla seta. Milano. Relazione (*annua*) *sull'attività del Laboratorio*. Milano.
Libertà (*La*) *economica*. Bologna.
Libri (*I*) *del giorno*. Milano.
Macchina (*La*) *nell'agricoltura*. Milano.
Magistrato (*R.*) *delle Acque. Ufficio idrografico*. — 1. *Bollettino bibliografico*. — 2. *Relazione annuale del Direttore*. Venezia.
Malpighia. Rassegna mensile di botanica. Catania.
Metallurgia (*La*) *italiana*. Milano.
Meteorologia (*La*) *pratica*. Mon ecassino.
Metron. Padova.
Minerva. Rivista delle riviste. Roma.
Miniera (*La*) *italiana*. Roma.
Ministero di Agricoltura, Industria e Commercio: 1. *Bollettino dei Ministeri per l'Agricoltura e per l'Industria, il Commercio*. Serie A. Roma.
Direzione generale delle Miniere. *Circolari*. Roma.
Ministero degli Affari Esteri. Direzione generale degli affari commerciali. Rapporti. Roma.
Moderno (*Il*) *zooiatro*. Bologna.
Monitore (*Il*) *tecnico*. Milano.
Natura Milano.
Naturalista (*Il*) *siciliano*. Palermo.
Notizie periodiche di statistica agraria. Roma.
Nuova agricoltura del Lazio. Roma.
Nuova (*La*) *Notarisia*. Modena.
Nuova Rivista d'Industria e Commercio. Roma.
Nuovi Annali di agricoltura siciliana. Palermo.
Nuovo (*Il*) *Ercolani. Rivista di medicina veterinaria*. Torino.
Nuovo Giornale botanico italiano. Firenze.
Orticoltura (*L'*) *italiana*. Torino.
Propaganda (*La*) *agricola*. Bari.
Pubblicazioni della Stazione agraria sperimentale in Bari per lo studio dell'aridocultura. Bari.
Rapporti e Monografie coloniali. Ministero degli Affari Esteri. Roma.
Rassegna delle Scienze biologiche. Firenze.
Rassegna mineraria, metallurgica e chimica. Roma.
Redia. Giornale di Entomologia. Firenze.
Relazione e bilancio industriale. Azienda dei Tabacchi. Ministero delle Finanze. Direzione Generale delle Privative. Roma.
Rendiconti del R. Istituto Lombardo di Scienze e Lettere. Milano.
Riforma (*La*) *agraria*. Parma.
Rivista agraria polesana. Rovigo.
Rivista (*La*) *agricola*. Roma.
Rivista coloniale. Roma.
Rivista del freddo. Roma.
Rivista (*La*) *del Mezzogiorno*. Napoli
Rivista delle Provincie. Roma.
Rivista di agricoltura. Parma.
Rivista di Ampelografia. Alba.
Rivista di Biologia. Roma.
Rivista internazionale di scienze sociali e discipline ausiliari. Roma
Rivista italiana delle essenze e profumi. Milano.
Rivista italiana di ragioneria. Roma
Rivista meteorico-agraria. Roma.

Rivista olearia italiana. Roma.
Rivista di Patologia vegetale. Pavia.
Rivista pellagrologica italiana. Firenze.
Scientia. Rivista di scienza. Milano.
Scuola (R.) Superiore di Agricoltura, Portici : 1. *Annali.* — 2. *Annali della Stazione sperimentale per le malattie infettive del bestiame.* — 3. *Bollettino del Laboratorio di Zoologia generale ed agraria.* — 4. *Circolari del Laboratorio di Entomologia agraria.* Portici (Napoli).
Sicilia (La) industriale. Catania.
Sicurezza (La) e l'igiene dell'industria. Milano.
Sole (Il). Milano.
Stazione (R.) sperimentale di Agrumicoltura e Frutticoltura di Acireale : 1. *Annali.* — 2. *Bollettino.* — 3. *Circolari.* Acireale (Catania).
Stazioni (Le) sperimentali agrarie italiane. Modena.
Terra (La). Bollettino mensile della Federazione italiana dei piccoli proprietarii. Pavia.
Tribuna (La) coloniale. Roma.
Villa (La) ed il giardino. Roma.
Villaggio (Il) e i Campi. Milano.
Vita (La) italiana. Roma.

JAPAN.

Annals of the Phytopathological Society of Japan. Nishigahara, Tokyo.
Annuaire financier et économique du Japon. Ministère des Finances. Tokyo.
Botanical (The) Magazine. Tokyo.
Bulletin de l'Association Séricicole du Japon. Tokyo.
Bulletin of the Imperial Central Agricultural Experiment Station in Japan. Nishigahara, Tokyo.
Bulletin (The) of the Imperial Sericultural Experiment Station, Japan. Tokyo.
Chemical Technology. Tokyo.
Dai Nippon Sanrin Kwai hô (Bulletin de la Société forestière du Japon). Tokyo.
Dai Nippon Sansha Kwai hô (Bulletin de l'Association séricicole du Japon). Tokyo.
Financial Annual of Japan. Tokyo.
Formosan (The) agricultural Review. Taihoku.
Journal of the Chemical Society of Japan (Nippon Kwagaku Kwai Shi). Tokyo.
Journal of the College of Agriculture, Tokyo.
Jôzôshiken sho-hôkoku (Bulletin de la Station expérimentale de Fermentation). Tokyo.
Kôgyô-Kwagaku zasshi (The Journal of Chemical Industry). Tokio.
Nihon-jôzô-Kyokwai zasshi. (The Japanese Brewery Association Review). Tokyo.
Nippon Kwagaku Kôgyô shinbun. (The Nippon Chemical Industrial News). Tokyo.
Sanrin Iho (The Journal of the Forestry Bureau of the Department of Agriculture & Commerce). Tokyo.
Teikoku Nôkwai-hô (Bulletin de la Société impériale d'Agriculture). Tokyo.

JUGO-SLAVIA.

Annuaire statistique du Royaume de Serbie. Belgrade.
Gospodarski List. Zagreb.
Jugoslavia. Belgrad.

LATVIA.

The Latvian Economist. Riga.

MAURITIUS.

Department of Agriculture : 1. *Leaflet Series.* Port-Louis. — *Bulletin.* 2. *General Series.* — 3. *Scientific Series.* — 4. *Statistical Series.* Reduit.

MEXICO.

Anuario estadistico de la República mexicana. México.
Jalisco rural. Guadalajara. Jal. Méx.
Memorias y Revista de la Sociedad Cientifica « Antonio Alzate », México.
Revista (La) agricola. México.

NETHERLANDS AND COLONIES.

Aperçu du Commerce et de l'Industrie. Ministère royal néerlandais de l'Agriculture, de l'Industrie et du Commerce. Leyde.
Archief voor de Rubbercultuur in Nederlandsch-Indië. Buitenzorg, Java.
Archief voor de Suikerindustrie in Nederlandsch-Indië. Soerabaja.
Bulletin van het Departement van den Landbouw in Suriname. Paramaribo.
Bulletin du Jardin Botanique, Département de l'Agriculture, de l'Industrie et du Commerce aux Indes Néerlandaises. Buitenzorg.

Bull. Mens. de l'Office permanent de l'Institut International de Statistique. La Haye

Cerealia. Rotterdam.

Cultura. Wageningen.

Deli Proefstation: 1. *Bulletin van het Deli Proefstation.* — 2. *Mededeelingen van het Deli Proefstation te Medan.* Medan, Sumatra.

Dutch (The) East Indian Archipelago. Buitenzorg.

Economische Verslagen van de Nederlandsche Diplomatieke en Consulaire Ambtenaren (Supplément aux *Handelsberichten*). 's Gravenhage.

Genetica. Nederlandsch Tijdschrift voor Erfelijkheids- en Afstammingsleer. 's Gravenhage.

Handelsberichten. 's-Gravenhage.

Holland's East India. Buitenzorg.

Huiles et Graisses. Amsterdam.

Indische (De) Mercuur. Amsterdam.

Jaarboek van het Departement van Landbouw, Nijverheid en Handel in Nederlandsch Indië. Batavia.

Jaarverslag van het Proefstat. voor de Java Suikerindustrie. Soerabaia.

Java. Departement van Landbouw, Nijverheid en Handel. Batavia.

1. *Mededeelingen uitgaande van het Departement van Landbouw,* Batavia.

2. *Mededeelingen van het algemeen Proefstation voor den Landbouw.* Buitenzorg.

3. *Mededeelingen van het agricultuur chemisch Laboratorium.* Buitenzorg.

4. *Mededeelingen uit den Cultuurtuin.* Buitenzorg.

5. *Mededeelingen van het Kina Proefstation.* Buitenzorg.

6. *Mededeelingen van het Laboratorium voor Agrogeologie en Grondonderzoek.* Buitenzorg.

7. *Mededeelingen van het Laboratorium voor Plantenziekten,* Buitenzorg.

8. *Mededeelingen van het Proefst. voor het Boschwezen.* Buitenzorg.

9. *Mededeelingen van het Proefstation voor Rijst c. a.* Buitenzorg.

10. *Mededeelingen van het Proefstation voor Tabak.* Buitenzorg.

11. *Mededeelingen van het Proefstation voor The.* Buitenzorg.

12. *Korte Berichten voor Landbouw, Nijverheid en Handel. Mededeelingen van het Statistich Bureau.* Buitenzorg.

13. *Korte Berichten uitgaande van den Landbouwvorlichtingsdients van het Department van Landbouw, Nijverheid en Handel. Selectie en Zaadtuin te Buitenzorg.* Buitenzorg.

14 *Mededeelingen van het Statistisch Bureau.* Buitenzorg.

15. *Veeartsenijkundige Mededeelingen.* Buitenzorg.

Maandschrift van den Nederlandsch. Maatschappij voor Tuinbouw en Plantkunde. Leiden.

Mededeelingen van de Landbouwhoogeschool en van de daaraan verbonden Instituten. Wageningen.

Mededeelingen van de Rijks Hoogere Land- Tuin- en Boschbouwschool en van de daaraan Verbonden Instituten. Wageningen.

Mededeelingen van het algeemen Proefstation der Avros: 1. *Algemeene Serie.* — 2. *Rubber Serie.* Medan.

Mededeelingen van het Besoekish Proefstation: 1. *Algeemeene Serie.* — 2. *Rubberserie.* Djember, Java.

Mededeelingen van het Proefstation voo-Vorstenlandsche Tabak. Klaten, Soerakarta, Java.

Nederlandsch Tijdschrift voor Melkhygiene. Amsterdam.

Nederlandsch Weekblad voor Zuivelbereiding en Veeteelt. Doetinchen.

Nijhoff's Index op de nederl. Periodieken van algemeenen Inhoud. 's-Gravenhage.

Octrooischriften van het Octrooiraad Nederland. s-Gravenhage.

Oliën, Vetten en Olienzaden. Amsterdam.

Paard (Het). 's-Gravenhage.

Phytopathologisch Laboratorium Willie Commelin Scholten: 1. *Vlugblad.* — 2. *Mededeelingen.* Amsterdam.

Repertorium op de Nederlandsche Tijdschriften en Voornaamste Dagbladen. Den Haag.

Tectona. Boschbouwkundig Tijdschrift. Buitenzorg.

Teysmannia. Batavia.

Thee (De). Buitenzorg.

Tijdschrift over Plantenziekten. Wageningen.

Tijdschrift voor Diergeneeskunde. 's-Gravenhage.

Tijdschrift voor economische Geographie. 's-Gravenhage.

Tijdschrift der nederl. Heidemaatschappij. Arnhem.

Treubia. Recueil de Travaux zoologiques, hydrobiologiques et océanographiques. Buitenzorg.

Veldbode (De). Maastricht.

Verkort meteorologisch Jaarboek. Kon. Nederlandsch Meteorologisch Instituut. Utrecht.

'erslagen van Landbouwkundige Onderzoekingen der Rijkslandbouw-proefstations. 's-Gravenhage.
'erslagen en Mededeelingen van de Directie van den Landbouw. 's-Gravenhage.
'est-Indië. Paramaribo.

NEW ZEALAND.

nnual Report of the Department of Agriculture of New Zealand. Wellington.
'ew (The) Zealand Journal of Agriculture. Wellington.
'ew (The) Zealand Journal of Science and Technology. Wellington.
'ew Zealand Official Yearbook. Wellington.

NORWAY.

'eretning fra Forings forsøksstationen ved Landbrukshøiskolen. Kristiania.
eretning fra Forings- forsøkene ved Norges Landbrukshøiskole. Kristiania.
'eretning fra Statens Forsøksgaard paa Hedemarken. Kristiania.
eretning om Hedemarkens Amts Forsøksstations virksomhet. Kristiania.
eretning om Norges Landbrukshøiskoles virksomhet. Kristiania.
eretning om skadeinsekter of plantesygdommer i land- og havebruket. Kristiania.
eretning om Statens kemiske Kontrollstations og Frøkontrolanstalts i Kristiania virksomhet. Kristiania.
eretning om Veterinaervaesenet og Kjødkontrollen i Norge. Kristiania.
eretninger om Amternes økonomiske Tilstand. Kristiania.
ndmandsforbundet. Kristiania.
ddelelser fra det Norske Myrselskap. Kristiania.
ddelelser fra det Statistiske Centralbyraa. Kristiania.
rges Utenrikshandel. Kristiania.
rsk Jaeger og Fisker Forenings Tidskrift. Kristiania.
rsk Pristidende. Kristiania.
rsk Veterinaer-Tidsskrift. Kristiania.
nvirke. Kristiania.
dsskrift for det norske Landbruk. Kristiania.
eskrift for Landbruk. Kristiania.

OTOMAN EMPIRE.

British (The) Chamber of Commerce of Turkey and the Balkan States. — Monthly Trade Journal. Galata, Constantinople.
Hachaklai. Or the Palestinian Agriculturist. Jaffa (Palestina).

PARAGUAY.

Anuario estadistico. República del Paraguay. Asunción.
Boletín de la Dirección de Tierras y Colonias. Asunción. Revista del Comercio. Asunción.
Diario oficial de la República del Paraguay. Asunción.
Revista del Comercio. Asunción.
Revista de la Escuela de Comercio. Asunción.

PERU.

Boletín del Ministerio de Fomento. Lima.

PHILIPPINES.

Philippine (The) Agricultural Review. Manila.
Philippine (The) Agriculturist. Los Baños.
Philippine (The) Journal of Science.

POLAND.

Dziennik Urzedowy Ministerstwa Rolnictwa i Dóbr Państwowych Rzeczypospolitej Polskiej. Warszawa.
Dziennik Urzedowy Ministerstwa Rolnictwa i Dobr Państwowych Rzeczypospolitej Polskiej. Dodatek : Obwieszenia Publiczne. Warszawa.
Misieczenik Ogrodniczy (Revue horticole mensuelle). Lwow.
Viribus Unitis. Mensuel consacré aux problèmes économiques des États de l'Europe centrale et orientale. Varsovie.

PORTO-RICO.

Agricultural Experiment Station, Portorico: Mayaguez: 1. *Bulletin.* — 2. *Circulars.* — 3. *Estación Experimental Agrícola, Boletín.* — 4. *Est. Exp. Agr. Circulares.* — 5. *Annual Report.*
Río Piedras: *Department of Agriculture and Labour, Insular Exp. Sta.:* 1. *Bulletin.* — 2. *Annual Report.*

Government of Porto Rico. Board of Commissioners of Agriculture: 1. *Bulletin.*—2. *Circulars.* Rio Piedras, P.R.
Journal (The) of the Department of Agriculture of Porto Rico. Rio Piedras, P. R.
Revista de Agricultura de Puerto Rico. San Juan, P. R.

PORTUGAL AND COLONIES.

Annuario da Universidade de Coimbra. Coimbra.
Annuario dos Serviços florestaes e aquicolas. Boletim da Direcção Geral da Agricultura. Ministerio do Fomento. Lisboa.
Annuario estadistico de Portugal. Ministerio das Finanças. Lisboa.
Boletim da Associação central de Agricultura portuguesa. Lisboa.
Boletim da Direcção Geral da Agricultura. Ministerio de Fomento. Lisboa.
Boletim de Agricultura. Lourenço Marques, Moçambique.
Boletim de Agricultura, Pecuaria e Fomento. Loanda.
Boletim de Comercio, Agricultura e Fomento da Provincia de Timor. Dili, Timor.
Boletim do Fomento. Nova Goa.
Boletim do Ministerio da Agricultura. Lisboa.
Bulletin de la Société portuguaise des Sciences naturelles. Lisbonne.
Broteria: Serie botanica — Serie de Vulgarização scientifica — Serie zoologica. Braga.
Diario do Governo et *Apêndice do Diario do Governo: Boletim de Propiedade industrial.* Lisboa.
Economista (O) portuguez. Lisboa.
Jornal de Sciencias mathemáticas, fisicas e naturais. Lisboa.
Revista agronomica. Lisboa.
Revista colonial. Lisboa.
Revista da Faculdade de Direito da Universidade de Lisboa. Lisboa.

RUMANIA.

Annarul Societâtei centrale agricole a proprietarilor si cultivatorilor din România. Bucureşti.
Annarul Statistic al României. Bucureşti.
Analele statistice şi economice. Bucuresti.
Besarabia agricola. Chisinan.
Buletinul agriculturii. Bucureşti.
Buletinul Culturii Tutunului. Bucuresti.
Buletinul statistic al Romaniei. Bucureşti.
Correspondance économique. Boucarest.
Viata agricola. Bucureşti.

SAN SALVADOR.

Anuario. Dirección general de Estadistica y Observatorio nacional. República de El Salvador. San Salvador.
Boletin del Ministerio de Relaciones exteriores. San Salvador.
Boletin de Agricultura, y Fomento. San Salvador.
Boletin del Consejo superior de Salubridad. San Salvador.
Boletin popular de la Dirección general de Agricultura e Industrias de El Salvador. San Salvador.
Revista de Agricultura tropical. San Salvador.

SOUTH AFRICA.

Annual Report. Division of Entomology. Pretoria.
Department of Agriculture: 1 *Bulletin* — 2. *Journal.* — 3. *Crop Report.* — 4. *Publications.* — 5. *Science Bulletin.* Pretoria.
Farmers' (The) Weekly. Bloemfontein.
Landbouw-Weekblad (Die). Bloemfontein.
National Botanic Gardens. Economic Bulletin. Kirstenbosch.
South African Farmers' Advocate. Bloemfontein.
South African Journal of Industries. Pretoria.
South (The) African Journal of Science. Cape Town.
Sun and Agricultural Journal of South Africa. Johannesburg.
Union (The) of South Africa Government Gazette. Pretoria.
Year Book (Official) of the Union of South Africa. Pretoria.

SPAIN.

Agricultura. Barcelona.
Anuario del Observatorio central meteorológico. Madrid.
Anuario estadistico de España. Madrid.
Agricultura (La) nacional. Madrid.
Boletin arrocero. Valencia.
Boletin de Agricultura técnica y economica (Dirección general de Agricultura, Minas y Montes). Madrid.
Boletin de Información de la Estación sericicola. Puerto de Santa Maria.

Boletín de la Asociación de Agricultores de España. Madrid.
Boletín de la Junta central de Colonización y Repoblación interior. Madrid.
Boletín de la Real Academia de Ciencias y Artes de Barcelona. Barcelona.
Boletín de la Real Sociedad Española de Historia natural. Madrid.
Boletín de la Real Sociedad Geográfica y Revista de Geografía colonial y mercantil. Madrid.
Boletín de las Cámaras de Comercio, Industria y Navegación y de las Cámaras agrícolas. Madrid.
Boletín del Museo pedagógico de Ciencias naturales. Barcelona.
Boletín oficial de la Dirección general de Comercio e Industria. Madrid.
Boletín oficial de Minas y Metalurgia. (*Ministerio de Fomento*). Madrid.
Boletín oficial de la Real Sociedad española de los Amigos del Árbol. Madrid.
Boletín trimestral de la Estación central de Ensayo de Semillas. La Moncloa, Madrid.
Butlletí del Museo Social. Barcelona.
Cataluña textil. Barcelona.
Cultivador (*El*) *moderno.* Barcelona.
España forestal. Madrid.
Hojas divulgadoras (*Ministerio de Fomento, Dirección general de Agricultura, Minas y Montes*). Madrid.
Ibérica. Tortosa.
Industria (*La*) *pecuaria.* Madrid.
Industria (*La*) *química.* Barcelona.
Información (*La*) *agrícola.* Madrid.
Mercados (*Los*). Valencia.
Resúmenes mensuales de la Estadística del Comercio exterior de España. Madrid.
Revista industrial y financiera. Madrid.
Revista del Instituto agrícola Catalán de S. Isidro. Barcelona.
Revista de la R. Academia de ciencias exactas físicas y naturales de Madrid. Madrid.
Revista de Montes. Madrid.
Revista (*La*) *vinícola y de Agricultura.* Zaragoza.
Vinicultura (*La*) *española.* Madrid.

SWEDEN.

Archiv för Botanik. Stockholm.
Archiv för Kemi, Mineralogi och Geologi. Stockholm.
Årsberättelse. Hydrografiska Byrån. Stockholm.
Årsbok (*Statistisk*) *för Sverige Kungl. Statistiska Centralbyrån.* Stockholm.
Centralanstalten för försöksväsendet på jordbruks-området Flygblad. Stockholm.
Centralanstalten för försöksväsendet på jordbruksområdet, Entomologiska Afdelningen. Uppsala.
Fataburen. Stockholm.
Geografiska Annaler. Stockholm.
Jönköpings Läns Hushallningssallskaps Handlingar och Tidskrift. Jönköping.
Kalmar Läns Södra Kungl. Hushallningssällskaps Periodiska Skrift. Kalmar.
Kommersiella Meddelanden. Stockholm.
Kungl. Landtbruks-Akademiens Handlingar och Tidskrift. Stockholm.
Landtmannen. Tidskrift för Landtmän. Stockholm.
Malmöhus Läns Hushallningssallskhjaps Kwartalsskrift. Malmö.
Månadsöversikt över väderlek och vattentillgång. Statens Meteorologisk-Hydrografiska Anstalt. Stockholm.
Nederbörden i Sverige (*Statens Meteorologisk — Hydrografiska Anstalt*). Stockholm.
Patenter. Beskrivning offentliggjord av Kungl. Patent-och Registreringsverket. Stockholm.
Skandinavisk Veterinär-Tidskrift. Experimentalfältet (Stockholm).
Skogen. Stockholm.
Skogsvårds - Föreningens Tidskrift. Stockholm.
Svensha Landtmännens Föreningsblad. Malmö.
Svenska Mosskulturföreningens Tidskrift. Jönköping.
Svenska Svinavelsföreningens Tidskrift. Stockholm.
Svenska Vägföreningens Handlingar. Stockholm.
Svenskt Land. Stockholm.
Svensk Veterinärtidskrift. Stockholm.
Sveriges allmänna landtbrukssällskaps Medlemsblad. Stockholm.
Sveriges Pomologiska Förenings Aarskrift. Stockholm.
Sveriges Utsädesförenings Tidskrift. Svalöf.
Tidning for Stockholms Länd Hushaällningssällskap. Stockholm.

Vattenstånden i Sverige. Statens Meteorologisk-Hydrografiska Anstalt. Stockholm.
Ymer. Stockholm.

SWITZERLAND.

Annuaire agricole de la Suisse. Berne.
Annuaire statistique de la Suisse - Jahrbuch der Schweiz. Berne.
Archives des Sciences physiques et naturelles. Genève.
Bericht des schweizerischen Wirtschafts-Archivs in Basel. Basel.
Bulletin de la Société botanique de Genève. Genève.
Bulletin de la Société Vaudoise de Sciences naturelles. Lausanne.
Bulletin de l'Association des Maraîchers de Genève. Genève.
Bulletin de l'Office vétérinaire et de la Division de l'Agriculture. Departement de l'Économie publique. Berne.
Bulletin des Eidgenössischen Gesundheitsamtes. Beilage : Gegen die Tuberkulose. Bern.
Bulletin du Département fédéral de l'Agriculture. Berne.
Bulletin suisse de Pêche et Pisciculture. Neuchâtel.
Emmenthaler-Blatt e supplemento : *Sprechsaal f. Milchwirtsch.* Langnau.
Helvetica Chimica Acta. Bâle et Genève.
Jahresbericht der Bernischen Molkereischule in Rütti-Zollikofen. Zollikofen.
Journal forestier suisse. Berne.
Landwirt (Der). Luzern.
Landwirtschaftliches Jahrbuch der Schweiz. Bern.
Marques internationales. Berne.
Mitteilungen aus dem Gebiete der Lebensmitteluntersuchung und Hygiene. Bern.
Patent-Liste. Bern.
Propriété (La) industrielle. Berne.
Rapport annuel du Comité directeur de l'Union suisse des Paysans et du Secrétariat des Paysans suisses. Brougg.
Rapport de la Station viticole et du Service phylloxérique. Département de l'Agriculture, de l'Industrie et du Commerce. Lausanne.
Rivista Internazionale di Sanità publica. Ginevra.
Schweizer Archiv für Tierheilkunde. Zürich.
Schweizerische Bienen-Zeitung. Aarau.
Schweizerische Fischerei-Zeitung. Pfäffikon, Zürich.
Schweizerische Handelsstatistik. Bern.
Schweizerische landwirtschaftliche Zeitschrift. Zürich.
Schweizerische Milchzeitung. Schaffhausen.
Schweizerische Obst- und Gartenbau-Zeitung. Münsingen, Bern.
Schweizerische Wein-Zeitung. Zürich.
Schweizerische Zeitschrift für Forstwesen. Bern.
Schweizerische Zeitschrift für Kleinviehzucht. Eschlikon.
Schweizerisches Zentralblatt für Milchwirtschaft. Brugg.
Statistisches Jahrbuch der Schweiz. Bern.
Terre (La) vaudoise. Lausanne.
Zeitschrift für schweizerische Statistik und Volkswirtschaft. Bern.

TUNIS AND FRENCH COLONIES.

Annuaire. Association des Anciens Elèves de l'Ecole coloniale d'Agriculture de Tunisie. Tunis.
Annuaire de la Nouvelle-Calédonie et Dépendances. Nouméa.
Annuaire économique et financier. Protectorat français au Maroc. Casablanca.
Annuaire (Grand) Général de l'Algérie, de la Tunisie et du Maroc. Alger.
Annuaire général de Madagascar et Dépendances. Tananarive.
Archives des Instituts Pasteur de l'Afrique du Nord. Alger-Tunis.
Association (L'). Tunis.
Bulletin administratif de la Cochinchine. Saïgon.
Bulletin administratif du Cambodge. Phonôm-Penh.
Bull. administratif du Laos. Vientiane.
Bull. administratif du Tonkin. Haïphng.
Bulletin agricole de l'Algérie-Tunisie-Maroc. Alger.
Bulletin agricole de l'Institut scientifique de Saïgon. Saïgon.
Bulletin comparatif trimestriel du Mouvement commercial et maritime de l'Algérie. Alger.
Bulletin de la Chambre d'Agriculture de la Cochinchine. Saïgon.
Bulletin de la Chambre d'Agriculture de Tahiti et de Moorea. Papeete.
Bulletin de la Direction générale de l'Agriculture, du Commerce et de la Colonisation et supplement. *Mémoires et Documents.* Tunis.
Bulletin de la Société d'Histoire naturelle de l'Afrique du Nord. Alger.

Bulletin de la Société d'Horticulture de Tunisie. Revue horticole, apicole, avicole tunisienne. Tunis.
Bulletin de la Station agronomique de la Guadeloupe. Pointe-à-Pitre, Antilles.
Bulletin de la Station de Recherches forestières du Nord de l'Afrique. Alger.
Bulletin de Renseignements sur la Situation économique et politique de l'Afrique occidentale française. Dakar.
Bulletin des Chambres d'Agriculture de la Guadeloupe et Dépendances. Pointe à-Pitre.
Bulletin économique de l'Indochine. Hanoï.
Bulletin économique du Maroc. Rabat.
Bulletin économique publié par les soins du Gouvernement général. Tananarive.
Bulletin financier de l'Indochine. Saïgon.
Bulletin officiel du Gouvernement général de l'Algérie. Alger.
Bulletin officiel du Protectorat de la République française au Maroc. Rabat.
Chambre Consultative Mixte de Commerce et d'Agriculture du Cambodge. Procès-Verbal. Phnom-Penh.
Chêne-Liège (Le). Bône, Algérie.
Colonisation (La) française au Maroc. Casablanca.
Feuille de Renseignement de la Direction de l'Agriculture, du Commerce et de la Colonisation au Maroc. Rabat.
Feuille d'Informations commerciales de la Direction générale de l'Agriculture, du Commerce et de la Colonisation de Tunisie. Tunis.
Journal de la Station agronomique de la Guadeloupe. Pointe-à-Pitre.
Lait (Le) Colon. Alger.
Revue agricole. Nouméa.
Revue agricole de l'Afrique du Nord. Alger.
Revue agricole de l'Île de la Réunion. Saint-Denis.
Revue agricole et vétérinaire de Madagascar et Dépendances. Tananarive.
Revue horticole de l'Algérie. Alger.
Revue indochinoise. Hanoï.
Revue tunisienne. Tunis.
Taux (Le) des colons. Alger.

UNITED STATES.

Abstracts of Bacteriology. Baltimore, Md.
Academy of Sciences, Chicago: 1. *Bulletin* — 2. *Annual Report.* Chicago, Ill.
Agricultural (The) Digest. New York.
Agricultural Experiment Station.

Alabama: Auburn: 1. *Bulletin of the Agr. Exp. Sta. of the Alabama Polytechnic Institute.* — 2. *Circulars.* — 3. *Annual Report.*

Tuskegee: *Tuskegee Normal and Industrial Institute, Exp. Sta.* 1. *Bulletin.* — 2. *Farmers' Leaflets.* — 3. *Annual Report.*

Alaska: Sitka: 1. *Bulletin.* — 2. *Circulars.* — 3. *Annual Report.*

Arizona: Tucson: 1. *Bulletin of the Agric. Exp. Sta. University of Arizona.* — 2. *Annual Report.*

Arkansas: Fayetteville: 1. *Bulletin.* 2. *Annual Report.*

California: Berkeley: *University of California Publications, College of Agriculture, Agr. Exp. Sta.:* 1. *Bulletin.* — 2. *Circulars.* — 3. *Library Bulletin.* — 4. *Annual Report.*

Colorado: Fort Collins: *Agric. Exp. Sta., Colorado Agricultural College:* 1. *Bulletin.* — 2. *Press Bulletin.* — 3. *Annual Report.*

Connecticut: New Haven: 1. *Connecticut Agric. Exp. Sta. Bulletin.* — 2. *Yale University, Yale Forest School, Bulletin.* — 3. *Annual Report.*

Storrs: *Storrs Station Bulletin.*

Delaware: Newark: 1. *Bulletin of the Delaware College Agric. Exp. Sta.* — 2. *Annual Report.*

Florida: Gainesville: 1. *Bulletin of the Exp. Sta. of Florida at the State Agricultural College.* — 2. *Annual Report.*

Georgia: Experiment Station: 1. *Bulletin of the Georgia Exp. Sta. State College of Agriculture and Mechanic Arts.* — 2. *Circulars.* — 3. *Annual Report.*

Hawaii: Honolulu: 1. *Bulletin.* — 2. *Extension Bulletin.* — 3. *Press Bulletin.* — 4. *Annual Report.* — *Sugar Planters' Station, Bulletin:* 5. *Agricultural and Chemical Series.* — 6. *Division of Entomology.* — 7. *Division of Pathology and Physiology.* — 8. *Special Bulletin, Division of Agriculture and Chemistry.*

Idaho: Moscow: 1. *Bulletin of the Agric. Exp. Sta. University of Idaho.* — 2. *Annual Report.*

Illinois: Urbana: 1. *Bulletin of the Agric. Exp. Sta. University of Illinois.* — 2. *Circulars.* — 3. *Soil Report.* — *Annual Report.*
Springfield: 1. *Illinois Farmers' Institute, Bulletin.* — 2. *Stallion Registration Board, Bulletin.* — 3. *Annual Report.*

Indiana: Lafayette: *Purdue University Agricultural Experiment Station.* 1. *Bulletin.* — 2. *Circulars.* 3. *Annual Report.*

Iowa: Ames: *Agric. Exp. Sta., Iowa State College of Agriculture and Mechanic Arts.* 1. *Bulletin.* — 2. *Press Bulletin.* — 3. *Research Bulletin.* — 4. *Annual Report.*

Kansas, Manhattan: *Agric. Exp. Sta. Kansas State Agric. College*: 1. *Farm Bulletin.* — 2. *Technical Bulletin.* — 3. *Circulars.* — 4. *Inspection Circulars.* — 5. *Annual Report.*

Kentucky: Lexington: *Agric. Exp. Sta. of State University.* — 1. *Bulletin.* — 2. *Annual Report.*

Louisiana: Audubon Park, New Orleans: *Sugar Station Bulletin.*
Baton Rouge: 1. *Bulletin.* — 2. *Annual Report.*

Maine: Orono: 1. *University of Maine, Maine Agric. Exp. Sta., Bulletin.* — 2. *University of Maine, Agricultural Extension Service, Extension Bulletin.* — 3. *Agric. Exp. Sta. Official Inspection.* — 4. *Annual Report.*

Maryland: College Park: 1. *The Maryland State College of Agriculture, Agric. Exp. Sta. Bulletin.* — 2. *Agric. College Quarterly.* — 3. *Annual Report.*

Massachusetts: Amherst: 1. *Bulletin.* — 2. *Bulletin, Control Series.* — 3. *Meteorological Bulletin.* — 4. *Annual Report.*

Michigan: East Lansing: 1. *Bulletin of the Agric. Exp. Sta. Michigan State Agric. College.* — 2. *Circulars.* — 3. *Special Bulletin.* — 4. *Technical Bulletin.* — 5. *Annual Report.*

Minnesota: St. Paul: 1. *Bulletin of the Agr. Exp. Sta. University of Minnesota.* — 2. *Annual Report.*

Mississippi: Jackson: 1. *Bulletin.* — 2. *Circulars.* — 3. *Annual Report.*

Missouri: Columbia: 1. *Bulletin of the Agric. Exp. Sta. University of Missouri.* — 2. *Circulars.* — 3. *Research Bulletin.* — 4. *Annual Report.*

Mountain Grave: *Fruit Station Bulletin.*

Montana: Bozeman: 1. *Bulletin of the Agric. Exp. Sta. Montana Agric. College.* — 2. *Circular.* — 3. *Annual Report.*

Nebraska: Lincoln: 1. *The University of Nebraska Bulletin of the Agric. Exp. Sta.* — 2. *Press Bulletin.* — 3. *Annual Report.*

Nevada: Reno: 1. *Bulletin of the Agric. Exp. Sta. University of Nevada.* — 2. *Circulars.* — 3. *Annual Report.*

New Hampshire: Durham: 1. *Bulletin.* — 2 *Scientific Contributions.* — 3. *Annual Report.*

New Jersey: New Brunswick: 1. *Bulletin.* — 2. *Circulars.* — 3. *Special Bulletin.* — 4. *New Jersey State Agricultural College Extension Bulletin.* — 5. *Annual Report.*

New Mexico: Las Cruces: 1. *College of Agriculture and Mechanic Arts Bulletin.* — 2. *Annual Report.*

New York: Geneva: 1. *Bulletin.* — 2. *Circulars.* — 3. *Technical Bulletin.* — 4. *Annual Report.*
Ithaca: 1. *Home Nature Study Course.* — 2. *Cornell University College of Agriculture, Agric. Exp. Sta. Bulletin.* — *Cornell Station* 3. *Circulars;* 4. *Reading-Course for Farmers.* — 5. *Reading-Course for Farmers' Wives.* — 6. *The Cornell Reading-Courses. Lessons for the Farm Home.* — 7. *New York State College of Agriculture, Cornell University, Cornell Extension Bulletin* — 8. *Annual Report.*

North Carolina: Raleigh: 1. *Bulletin.* — 2. *Press Bulletin.* — 3. *Extension Circulars.* — 4. *Annual Report.*

North Dakota: Agricultural College: 1. *Bulletin.* — 2. *Annual Report.*

Ohio: Columbus: 1. *Agricultural College Extension Bulletin.* — 2. *Farmers' Reading Course.* — *Annual Report.*
Wooster: 1. *Bulletin.* — 2. *Circulars.* — 3. *Technical Series Bulletin.* — 4. *Annual Report.*

Oklahoma: Stillwater: *Oklahoma Agricultural and Mechanical College, Agric. Exp. Sta.:* 1 *Bulletin.* — 2. *Annual Report.*

Oregon : Corwallis: *Oregon Agricultural College and Experiment Station :* 1. *Station Bulletin.* — 2. *Circulars.* — 3. *Division of Horticulture Research Bulletin.* — 4. *Annual Report.*

Pennsylvania: Centre Country: *State Station :* 1. *Bulletin.* — 2. *Annual Report.*

Rhode Island : Kingston : *Agric. Exp. Sta. of the Rhode Island State College :* 1. *Bulletin.* — 2. *Annual Report.*

South Carolina : Clemson College : *South Carolina Agric. Exp. Sta. of Clemson Agric. College*: 1. *Bulletin.* — 2. *Annual Report.*

South Dakota: Brookings : 1. *Bulletin of the Agric. Exp. Sta. South Dakota State's College of Agriculture and Mechanic Arts.* — 2. *Annual Report.*

Tennessee : Knoxville : 1. *Bulletin of the Agric. Exp. Sta. University Tennessee.* — 2. *Annual Report.*

Texas : Austin, College Station : *Agricultural and Mechanical College of Texas.* 1. *Bulletin.* — 2. *Press Bulletin.* — 3. *Circulars.* — 4. *Annual Report.*

Austin : *Press Bulletin.*

Utah : Logan : *Agricultural College Exp. Sta :* 1. *Bulletin.* — 2. — *Circulars.* — 3. *Annual Report.*

Virginia : Norfolk : 1. *Truck Station Bulletin.* — 2. *Annual Report.*

Washington: Pullmann: 1. *Agr. Exp. Sta. Popular Bulletin.* — 2. *State Agricultural College and School of Sciences, Bulletin.* — 3. *Annual Report.*

West Virginia : Morgantown : *Agric. Exp. Sta. West Virginia University :* 1. *Bulletin.* — 2. *Circulars.* 3. *Annual Report.*

Wisconsin : Madison : 1. *Bulletin of the Agric Exp. Sta. University of Wisconsin.* — 2. *Circulars of Information.* — 3. *Research Bulletin.* — 4. *Special Bulletin.* — 5. *Annual Report.*

Wyoming : Laramie : *University of Wyoming Agric. Exp. Sta. :* 1. *Bulletin.* — 2. *Annual Report.*

ricultural Annual Index. New York.

ricultural (The) Review. Official Bulletin of the International Farm Congress. Dry Farming. Kansas City, Mo.

ricultura (La) Moderna. Sacramento, Cal.

Alumni Bulletin of the University of Virginia. Charlottesville Va.

American Agriculturist. Springfield, Mass.

American Bee Journal. Hamilton, Ill.

American (The) Botanist. Joliet.

American (The) Brewer. New York.

American (The) Economic Review. Cambridge, Mass.

American (The) Elevator and Grain Trade. Chicago.

American Exporter. New York.

American (The) Fertilizer. Philadelphia.

American Forestry. Washington.

American Fruit Grower. Chicago.

American Journal of Botany. Brooklyn, N. Y.

American (The) Journal of Science. New Haven, Conn.

American Miller. Chicago.

American (The) Naturalist. New York.

American (The) Sugar Bulletin. New York.

Americas (The). New York.

Annals of the Missouri Botanical Garden. Saint Louis, Mo.

Asia. Journal of the American Asiatic Association. New York.

Banker-Farmer (The). Champaign, Ill.

Better Farming Association of North Dakota. Press Bulletin. Fargo, N. D.

Bibliographical Contributions from the Lloyd Library. Cincinnati, Ohio.

Boletín de la Unión Pan-Americana Washington.

Book (The) Review Digest. New York.

Botanical Abstracts. Baltimore, Md.

Botanical (The) Gazette. Chicago, Ill.

Breeder's (The) Gazette. Chicago, Ill.

Brooklyn Botanic Garden: 1. *Record.* — 2. *Leaflets.* Brooklyn, N. Y.

Bulletin of the Delaware State Board of Agriculture. Dover, Del.

Bulletin of the Department of Agriculture of Maine. Waterville. Maine.

Bulletin of the Lloyd Library : 1. *Botany Series.* — 2. *Mycological Series.* — 3. *Pharmacy Series.* — 4. *Reproduction Series.* Cincinnati, Ohio.

Bulletin of the Pan-American Union. Washington.

Bulletin of the Vermont Department of Agriculture. St. Albans.

California Cultivator. Los Angeles. (San Francisco), Cal.

Chemical, Color and Oil Record. New York.

Colombian (The) Review. New York.

Commerce Monthly. New York.

Commercial Fertilizer. Atlanta, Ca.
Country (The) Gentleman. Philadelphia.
Country Life. Garden City, N. Y.
Creamery (The) and Milk Plant Monthly. Chicago.
Cuba (The) Review. New York.
Cumulative (The) Book Index. New York.
Dakota (The) Farmer. Aberdeen, S. D.
Ecology (continuing *The Plant World*). Brooklyn, N. Y.
Economic (The) World. New York.
Engineering and Mining Journal. New York.
Engineering News Record. New York.
Entomological News. Philadelphia.
Evening (The) Post. Cuba. New York.
Evening (The) Post. 1. *Foreign Trade Review*. — 2. *Electrical Industries Section*. — 3. *Industries Section*: — 3. *Cotton and Cotton Textiles*. — 4. *Tractors*. — 5. *Steel Industries Section*. New York.
Experiment Station Record. Washington.
Exporters' and Importer's Journal. New York.
Facts about Sugar. New York.
Farmer's (The) Wife. St. Paul. Minn.
Farm Implement News. Chicago, Ill.
Feedingstuffs. New York.
Field (The) Illustrated and System on the Farm. New York.
Florida (The) Grower. Tampa, Fl.
Florida Quarterly Bulletin of the Agricult. Depart. Tallahassee, Fl.
Genetics. Princeton, N. Y.
Geographical Review. New York.
Grain Dealers' Journal. Chicago Ill.
Hacienda (La). Buffalo.
Hoard's Dairyman. Fort Atkinson, Wis.
House & Garden. New York.
India Rubber World. New York.
Industrial Arts Index. New York.
Industrial Management (The Engineering Magazine). New York.
Journal of Agricultural Research. Washington.
Journal of Farm Economics. Lancaster, Pa.
Journal (The) of the American Chemical Society. Easton, Pa.
Journal of the American Society of Agronomy. Washington.
Journal of the American Veterinary Medical Association. Ithaca.
Journal of the Association of Official Agric. Chemists. Baltimore, Md.
Journal of Bacteriology. Baltimore, Md.
Journal of Biological Chemistry. Baltimore, Md.
Journal of Dairy Science. Baltimore, Md.
Journal of Economic Entomology. Concord, N. H.
Journal of Entomology and Zoology. Claremont, Cal.
Journal of Experimental Zoology. Philadelphia.
Journal of Farm Economics. Lancaster, Pa.
Journal of Forestry. Washington.
Journal (The) of General Physiology. Baltimore, Md.
Journal (The) of Geography. Madison.
Journal (The) of Heredity. Washington.
Journal (The) of Industrial and Engineering Chemistry. Easton, Pa.
Journal of the New York Botanical Garden. New York.
Journal (The) of Political Economy. Chicago, Ill.
Levant-American Commercial Review. Washington.
Louisiana (The) Planter and Sugar Manufacturer. New Orleans.
Massachusetts State Board of Agriculture, Nature Leaflet, Amerst. Mass.
Massachusetts Board of Education, Bulletin. Boston, Mass.
Massachusetts (Commonwealth of), Bureau of Statistics: 1. *Labor Bulletin* — 2. *Report on the Public Employmen Offices*. — 3. *Report on the Statistic of Manufactures*. Boston, Mass.
Monthly Bulletin of the Department o Agriculture. State of California. Sacramento, Cal.
Monthly Bulletin of the Missour State Board of Agriculture. Jefferso City, Mo.
Mycologia. Lancaster, Pa.
Mycological Notes by *C. G. Lloyd* Cincinnati, Ohio.
National (The) Geographic Magazine Washington.
National (The) Grange Monthly. Westfield, Mass.
Nebraska (The) Farmer. Lincoln, Neb
Nevada Bureau of Industry, Agricu ture and Irrigation. Bulletin,. Car son City, Nevada.
New York State Department of Agricu ture. Bulletin. Albany, N. Y.
New York State Museum Bulletin Botany; Entomology. Albany, N. Y
North Carolina State Department o Agriculture. Bulletin. Raleigh, N. C
North (The) Western Miller. Minneapolis.
Office of the Pathologist and Local U. S Weather Bureau Station for Rog

River Valley: 1. *Bulletin.* — 2. *Circulars.* — 3. *Press Bulletin.* Medford, Oregon.

Official (The) Gazette of the U. S. Patent Office. Washington, D. C.

Ohio (The) Department of Agriculture Official Bulletin. Columbus, Ohio

Oil, Paint and Drug Reporter. New York.

Operative (The) Miller. Chicago.

Pacific Fisherman. Settle.

Pennsylvania Farmer. Philadelphia. Penn.

Phytopathology. Washington.

Plant (The) Disease Bulletin. Washington.

Political Science Quarterly. New York.

Potato (The) Magazine. Chicago.

Proceedings of the Academy of Political Science in the City of New York. N. Y.

Proceedings of the National Academy of Science. Washington.

Producer (The) Denver, Col.

Psyche. A Journal of Entomology. Forest Hills, Boston.

Pure Products. New York.

Quarterly (The) Bulletin of the State Plant Board of Florida. Gainesville, Fla.

Quarterly (The) Journal of Economics. Cambridge, Mass.

Readers' Guide to Periodical Literature. White Plains, N. Y.

Reclamation Record. Washington.

Refrigerating World. New York.

Rice Journal and Southern Farmer. Crowley, Louisiana.

Rocky Mountain Husbandman. Great Falls, Montana.

Science. Garrison-on-Hudson, N. Y.

Scientific American. New York.

Soil Science. New Brunswick, N. Y.

Southern (The) Fruit Grower. Chattanooga, Tenn.

Spice (The) Mill. New York.

State of Minnesota. State Department of Agriculture. Bulletin. St. Paul, Minn.

State of New Jersey. Department of Agriculture. Bulletin. Trenton, N. J.

Sugar. New York.

Tea, (The) and Coffee Trade Journal. New York.

Tennessee Agriculture. Nashville.

Texas Department of Agriculture. Bulletin. Austin, Tex.

Textile World Journal. New York.

Terreya. Lancaster, Pa.

Transactions of the American Society of Agricultural Engineers. Ames, Iowa.

United States Department of Agriculture. Washington. 1 *Bulletin.* — 2. *Farmers' Bulletin.* — 3. *Farmers' Bulletin Outlook.* — 4. *Circulars of the Secretary.* — 5. *Department Circulars.* — 6 *Weekly News Letters to Correspondents.* — 7. *Yearbook.*— 8. *Annual Reports.*

Bureau of Animal Industry: 1. *Bulletin* — 2. *Circulars.* — 3. *Orders.* — 4. *Amendments to Orders.* — 5 *Cattle.* — 6. *Horses.* — 7. *Service and Regulatory Announcements.* — 8. *Publications.*

Bureau of Biological Survey: 1. *Bulletin.* — 2. *Circulars.* — 3. *North America Fauna.* — 4. *Service and Regulatory Announcements.*

Bureau of Chemistry: 1. *Bulletin.* — 2. *Circulars.* — 3. *Supplements.* — 4. *Service and Regulatory Announcements.*

Bureau of Crop Estimates: *Monthly Corp Reporter.*

Bureau of Entomology: 1. *Bulletin.* — 2. *Circulars.* — 3. *Technical Series Bulletin.*

Bureau of Labor Statistics: *Bulletin. Vocational-Educational Series.*

Bureau of Markets: 1. *Food Surveys.* — 2. *Service and Regulatory Announcements.* — 3. *Seed Reporter.*

Bureau of Plant Industry: 1. *Bulletin* — 2. *Circulars.* — 3. *Crop Physiology and Breeding Investigations Bulletin.* — 4. *Inventory of Seed and Plants Imported by the Office of Foreign Seed and Plant Introduction.* — 5. *Office of Foreign Seed and Plant Introduction Bulletin.* — 6. *Publications B. P. I.* — 7. *Service and Regulatory Announcements.* — 8. *Western Irrigation Agriculture.*

Bureau of Soils: 1. *Bulletin.*— 2. *Advance Sheets. Field Operations of the Bureau of Soils.* — 3. *Circulars.*

Bureau of Soils and Bureau of Plant Industry Cooperating: *Report.*

Bureau of Standards: *Bulletin.*

Bureau of Statistics: 1. *Bulletin.* — 2. *Circulars.*

Division of Publications: 1. *Circulars.* — 2. *Monthly List of Publications.* — 3. *Library Bulletin.*

Federated Horticultural Board: *Service and Regulatory Announcements.*

Forest Service: 1. *Bulletin.* — 2. *Circulars.* — 3. *Sylvical Leaflets.*

Insecticide and Fungicide Board: 1. *Service and Regulatory Announcements.* — 2. Library: *Bibliographical Contribution.* Washington.

Office of Experiment Stations: 1. *Bulletin.* — 2. *Bulletin of Experiment Station Work.* — 3. *Circulars.* — 4. *Farmers' Institute Lecture.* — 5. *Publications.*

Office of Markets and Rural Organization: *Service and Regulatory Announcements.*

Office of Public Roads: 1. *Bulletin.* — 2. *Circulars.*

Office of the Secretary: 1. *Circulars.* — 2. *Food Inspection Decision, Publications.* — 3. *Insecticide Decision, Circulars.* — 4. *Notices of Judgement.* — 5. *Publications.* — 6. *Report.*

Office of the Solicitor: *Circulars.*

States Relations Service: 1 *Department Circulars.* — 2. *List of Station Publications received by the Office of Exper. Sta.*

Weather Bureau: 1. *Climatological Data for the U. S. by Sections.* — 2. *Publications.* — 3. *Monthly Weather Review.* — 4. *National Weather and Crop Bulletin.*

United States Department of Commerce and Labor. Washington.

Bureau of Fisheries: *Documents.*

Bureau of Foreign and Domestic Commerce: 1. *Commerce Reports. Daily Consular and Trade Reports.* — 2. *Supplements (Consular Reports).* 3. *Monthly Summary of the Foreign Commerce of the United States.*

Bureau of Standards: 1. *Circulars.* — 2. *Miscellaneous Publications.* — 3. *Scientific Papers.* — 4. *Technologic Papers.*

United States Department of Interior. Washington.

Bureau of Mines: 1. *Bulletin.* — 2. *Miners' Circulars.* — 3. *Technical Paper.* — 4. *Annual Report by the Director of the Bureau of Mines to the Secretary of Interior.*

General Land Office: *Publications.*

U. S. Geological Survey: 1. *Bulletin.* — 2. *Water Supply Paper.*

University (The) of California: 1. *Chronicle, an Official Record.* — 2. *Library Bulletin.* Berkeley, Cal.

Wisconsin State Board of Agriculture Bulletin. Madison, Wis.

World Agriculture. Amherst, Mass.

Year Book of Commercial Fertilizers. Atalanta, Georgia.

URUGUAY.

Anuario de Estadística agrícola. República oriental del Uruguay. Montevideo.

Anuario estadístico de la República oriental del Uruguay. Montevideo.

Boletín de la Comisión nacional de Fomento rural. Montevideo.

Boletín del Consejo nacional de Higiene. Montevideo.

Boletín del Ministerio de Hacienda. Montevideo.

Boletín del Ministerio de Relaciones exteriores. Montevideo.

Defensa agrícola. Montevideo.

Hacendado (El). Montevideo.

Ministerio de Industrias. Inspección nacional de Ganadería y Agricultura. Boletín. Montevideo.

Propaganda (La) rural. Montevideo.

Propiedad (La) territorial. Montevideo.

Revista de Frutos del País. Montevideo.

Revista de la Asociación rural del Uruguay. Montevideo.

Revista de la Unión industrial uruguaya. Montevideo.

Revista del Centro Ganadero. Montevideo.

Revista del Ministerio de Industrias. Montevideo.

Revista quincenal de Frutos. Montevideo.

VENEZUELA.

Boletín del Ministerio de Fomento. Caracas.

WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES WITH THEIR ENGLISH EQUIVALENTS.

Archine (Russia)	=	27.99961 inches
Ardeb (Egypt)	=	5.44435 bushels
Ardeb of wheat (Egypt)	=	2.95264 cwt.
Ardeb of hulled maize (Egypt)	=	2.75580 cwt.
Ardeb of barley (Egypt)	=	2.36211 cwt.
Ardeb of undecorticated rice (Egypt)	=	5.72812 cwt.
Ardeb of decorticated rice (Egypt)	=	3.83813 cwt.
Arpent (Canada)	=	0.84501 acres
Are [100 square metres]	=	107.63915 square feet
Arroba (Brazil)	=	33.06951 lbs.
Arroba (Cuba, Guatemala, Paraguay, Peru)	=	25.35841 lbs.
Arroba (Mexico)	=	25.36657 lbs.
Bale of cotton (Brazil)	=	396.83415 lbs.
Bale of cotton (United States)	=	4.46431 cwt. (gross wt.)
" " " " "	=	4.26788 cwt (net wt.)
Bale of cotton (India)	=	3.57145 cwt.
Barrel of wheat flour (Canada, United States)	=	1.75001 cwt.
Bar, see Millier		
Bow (Java, Dutch Indies)	=	76.36998 square feet
Bushel (United States)	=	0.96896 bushels
Bushel of oats (United States)	=	32 lbs.
Bushel of oats (Canada)	=	34 lbs.
Bushel of wheat and potatoes (United States)	=	60 lbs.
Bushel of barley (Canada, United States)	=	48 lbs.
Bushel of raw rice (United States)	=	45 lbs.
Bushel of rye, hulled maize, linseed (Canada, United States)	=	56 lbs.
Cadastral arpent (Hungary)	=	1.42201 acres
Cental (United States)	=	100 lbs.
Centiare [10 square metres]	=	10.76392 square feet
Centigramme	=	0.15432 grains
Centilitre	=	0.0022 gallons
Centimetre	=	0.393715 inches
Centistere	=	0.35315 cubic feet
Centner (Germany, Austria, Denmark)	=	110.23171 lbs.
Centner (Sweden)	=	93.71238 lbs.
Cho [60 ken] (Japan)	=	119.30327 yards
Cho (Japan)	=	2.45068 acres
Crown [100 heller] (Austria-Hungary)	=	10*d* at par
Crown [100 öre] (Denmark, Norway, Sweden)	=	1*s* 1 1/8 *d* at par
Cubic centimetre	=	0.06102 cubic inches
Cubic metre	=	1.30795 cubic yards
Decagramme [10 grammes]	=	0.35275 oz.

1 Decalitre [10 litres]	=	2.19976 gallons
1 Decametre [10 metres]	=	32.80840 feet
1 Decare [1000 square metres]	=	1195.98627 square yards
1 Decastere [10 cubic metres]	=	13.07951 cubic yards
1 Deciare [10 square metres]	=	11.95986 square yards
1 Deciatine [2 tchetwert] (Russia)	=	2.69966 acres
1 Decigramme	=	1.54323 grains
	=	0.022 gallons
1 Decilitre	=	0.0027497 bushels
1 Decimetre	=	3.93701 inches
1 Decistere	=	3.53146 cubic yards
1 Dinar, gold [100 para] (Serbia)	=	9 $^{53}/_{64}$ *d* at par
1 Dollar, gold, $ [100 cents] (United States)	=	4 *s* 1 $^{9}/_{32}$ *d* at par
1 Drachm, gold [100 lepta] (Greece)	=	9 $^{53}/_{64}$ *d* at par
1 Dz. = Doppelzentner (Germany)	=	220.46341 lbs.
1 Egyptian kantar (Egypt)	=	99.04980 lbs.
1 Feddan Masri [24 Kirat Kamel] (Egypt)	=	1.03805 acres
1 Florin, gold, or Gulden [100 cents] (Netherlands)	=	1 *s* 7 $^{59}/_{64}$ *d* at par
1 Franc [100 centimes] (France)	=	9 $^{53}/_{64}$ *d* at par
1 Gallon (United States)	=	0.83270 gallons
1 gramme	=	0.03527 oz.
1 Hectare [10 000 square metres]	=	2.47109 acres
1 Hectogramme (100 grammes)	=	3.52746 oz.
	=	21.99755 gallons
1 Hectolitre [100 litres]	=	2.74967 bushels
1 Hectometre [100 metres]	=	109.36133 yards
1 Hectostere [106 cubic metres]	=	130.79505 cubic yards
1 Jarra (Mexico)	=	7.22642 quarts
1 Kadastral hold, see Cadastral arpent		
1 Kin (Japan)	=	1.32278 lbs.
1 Kokou [10 to] (Japan)	=	1.58726 quarts
1 Kokou of oats (Japan)	=	1.55014 cwt.
1 Kokou of cocoons (Japan)	=	82.67268 lbs.
1 Kokou of wheat and maize (Japan)	=	2.58356 cwt.
1 Kokou of barley (Japan)	=	2.06685 cwt.
1 Kokou of naked barley (Japan)	=	2.69428 cwt.
1 Kokou of rice (Japan)	=	2.80501 cwt.
1 Kopek (Russia)	=	1 $^{3}/_{200}$ farthing at par
1 Kwan (Japan)	=	8.26738 lbs.
1 Lei, gold [100 bani] (Rumania)	=	9 $^{53}/_{64}$ *d* at par
1 Leu [100 statinki] (Bulgaria)	=	9 $^{53}/_{64}$ *d* at par
1 Lira [100 centesimi] (Italy)	=	9 $^{53}/_{64}$ *d* at par
	=	0.21998 gallons
1 Litre	=	0.0275 bushel
1 Manzana (Nicaragua, Guatemala)	=	1.72665 acres
1 Mark [100 Pfennige] (Germany)	=	11 $^{3}/_{4}$ *d* at par
1 Mark [100 penni] (Finland)	=	9 $^{53}/_{64}$ *d* at par

Maund Factory (India)	=	74.6709 lbs.
Maund Imperial (India)	=	82.28136 lbs.
Metre	=	3.28084 feet
Milliare	=	1.07639 square feet
Milligramme	=	0.01543 grains
Millilitre	=	0.00022 gallons
Millimetre	=	0.03937 inches
Millistere	=	61.02361 cubic inches
Myriagramme [10 000 grammes]	=	22.04634 lbs.
Myrialitre [10 000 litres]	=	2 199.75539 gallons
	=	274.96701 bushels
Myriametre [10 000 metres]	=	6.21373 miles
Millier [1 000 000 grammes]	=	19.68426 cwt.
Milreis, gold (Brazil)	=	2s 2 $^{9}/_{16}$ *d* at par
Milreis, gold (Portugal)	=	4s 5 $^{19}/_{32}$ *d* at par
Minot (Canada)	=	1.07306 bushels
Morgen (Cape of good Hope)	=	2.11654 acres
Muid (Cape of good Hope)	=	24 gallons
	=	3 bushels
Oka (Greece)	=	2.75579 lbs.
Oke (Egypt)	=	2.75138 lbs.
Peseta, gold [100 céntimos] (Spain)	=	9 $^{33}/_{64}$ *d* at par
Peso, gold [100 centavos] (Argentina)	=	3s 11 $^{37}/_{64}$ *d* at par
Peso, gold [100 centavos] (Chili)	=	1s 5 $^{61}/_{64}$ *d* at par
Pic (Egypt)	=	2.46646 feet
Pikul (China)	=	133.27675 lbs.
Pikul (Japan)	=	132.27805 lbs.
Pood (Russia)	=	36.11292 lbs.
Pound, Egyptian, gold [100 piastres]	=	£1. 0. 6 $^{43}/_{64}$ at par
Pound, Turkish, gold [100 piastres] (Ottoman Empire)	=	18s 0 $^{51}/_{64}$ *d* at par
Pund (Sweden)	=	0.93712 lbs.
Quintal	=	1.96843 cwt.
Rouble, gold [100 kopeks] (Russia)	=	2s 1 $^{3}/_{16}$ *d* at par
Rupee, silver [16 annas] (British India)	=	1s 4 *d* at par
Square metre	=	1.19599 square yards
Stere [1 cubic metre]	=	1.30795 cubic yards
Sucre, silver (Ecuador)	=	1s 11 $^{51}/_{64}$ *d* at par
Tallari [20 piastres] (Egypt	=	4s 1 $^{11}/_{32}$ *d* at par
To (Japan)	=	0.49601 bushels
	=	3.96815 gallons
Ton (metric)	=	0.98421 tons
Verst (Russia)	=	1166.64479 yards
Yen, gold [2 fun or 100 sen] (Japan)	=	2s 0 $^{37}/_{64}$ *d* at par
Zentner (Germany)	=	110.23171 lbs.

In quoting articles, please mention this REVIEW.

CONTENTS

ERNAT. INST. OF AGRIC, *Internat. Review of Science and Practice of Agriculture.* Year XIII, No. 2. Rome, February, 1922.

PLANT DISEASES.

III. — DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

a) GENERAL.

In quoting articles, please mention this REVIEW.

CONTENTS

INAT. INST. OF AGRIC. *Internat. Review of Science and Practice of Agriculture.* Year XIII, No. 3. Rome, March, 1922.

III. — LIVESTOCK AND BREEDING.

a) GENERAL.

III. — Livestok and Breeding.

a) General.

IV. — Agricultural Machinery.

V. — Agricultural Industries.

PLANT DISEASES.

II. — Diseases not due to Parasites or of Unknown Origin.

III. — DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

a) GENERAL.

b) SPECIAL.

V. — INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

a) GENERAL.

b) SPECIAL

EDITORIAL STAFF OF THE BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES.

Chief of Bureau: DR. JULES-MICHEL SAULNIER.

Editors:

DR. GUIDO BORGHESANI, Chief Rédacteur.
PROF. GIULIO TRINCHIERI, Chief Rédacteur.
PROF. GIROLAMO AZZI, Chief Rédacteur.
THÉODORE BÆLER, Lic. ès Sc. phys. et mat., Chief Rédacteur.
DR. FRANCESCA DORIO.
FRÉDÉRIC SORG, Ing. Agr.
MARGARITE L. YEO, Dipl. Hort. Sc. Oxford & Reading.

In quoting articles, please mention this REVIEW.

CONTENTS

ERNAT. INST. OF AGRIC. *Internat. Review of Science and Practice of Agriculture.* Year XIII, No. 4 Rome, April, 1922.

b) SPECIAL.

III. — LIVESTOCK AND BREEDING.

a) GENERAL.

b) SPECIAL.

IV. — FARM ENGINEERING.

V. — RURAL ECONOMICS.

VI. — AGRICULTURAL INDUSTRIES.

PLANT DISEASES.

I. — General.

II.— Diseases not due to Parasites or of unknown origin

III. — Diseases due to Fungi Bacteria and other Lower Plants.

IV. — Weeds and Parasitic Flowering Plants.

V. — Injurious Insects and other Lower Animals.

a) General.

b) SPECIAL.

EDITORIAL STAFF OF THE BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES.

Chief of Bureau: DR. JULES-MICHEL SAULNIER.

Editors:

DR. GUIDO BORGHESANI, Chief Rédacteur.
PROF. GIULIO TRINCHIERI, Chief Rédacteur.
PROF. GIROLAMO AZZI, Chief Rédacteur.
THÉODORE BÎTÉLER, Lic. ès Sc. phys. et mat., Chief Rédacteur.
PAUL CASTELLAN Ing. Agr.
DR. FRANCESCA DORIO.
MARGARITE L. YEO, Dipl. Hort. Sc. Oxford & Reading.

The Editor's notes are marked (*Ed.*).

In quoting articles, please mention this REVIEW.

CONTENTS

TERNAT. INST. OF AGRIC. *Internat. Review of Science and Practice of Agriculture.* Year XIII, No. 5-6 Rome, May-June, 1922.

b) SPECIAL.

III. — Livestock and Breeding.

a) General.

b) Special.

IV. — FARM ENGINEERING.

VI. — AGRICULTURAL INDUSTRIES.

PLANT DISEASES.

I. — GENERAL INFORMATION.

III. — Diseases due to Fungi Bacteria and other Lower Plants.

a) General.

b) Special.

IV. — Weeds and Parasitic Flowering Plants.

V. — Injurious insects and other lower animals.

In quoting articles, please mention this REVIEW.

CONTENTS

ERNAT. INST. OF AGRIC. *Internat. Revie of Science and Practice of Agriculture.* Year XIII, No. 7. Rome, July, 1922.

III. — LIVESTOCK AND BREEDING.

a) GENERAL.

PLANT DISEASES.

III. — Diseases due to Fungi Bacteria and other Lower Plants.

IV. — Weeds and Parasitic Flowering Plants.

V. — Injurious Insects and other Lower Animals.

In quoting articles, please mention this REVIEW.

CONTENTS

INTERNAT. INST. OF AGRIC. *Internat. Review of Science and Practice of Agriculture* Year XIII, No. 8. Rome, August, 1922.

III. — LIVESTOCK AND BREEDING.

a) GENERAL.

b) SPECIAL.

PLANT DISEASES.

I. — GENERAL INFORMATION.

II. — DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

III. — DISEASES DUE TO FUNGI BACTERIA AND OTHER LOWER PLANTS.

a) GENERAL.

In quoting articles, please mention this REVIEW.

CONTENTS

III. — LIVESTOCK AND BREEDING.

a) GENERAL.

PLANT DISEASES.

II. — DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

III. — DISEASES DUE TO FUNGI BACTERIA AND OTHER LOWER PLANTS.

EDITORIAL STAFF OF THE BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES.

Chief of Bureau: DR. JULES-MICHEL SAULNIER.

Editors:

DR. GUIDO BORGHESANI, Chief Rédacteur.
Prof. GIULIO TRINCHIERI, Chief Rédacteur.
Prof. GIROLAMO AZZI, Chief Rédacteur.
THÉODORE BIÉLER, Lic. ès Sc. phys. et mat., Chief Rédacteur.
PAUL CASTELLAN Ing. Agr.
DR. FRANCESCA DORIO.
MARGARITE L. YEO, Dipl. Hort. Sc. Oxford & Reading.

In quoting articles, please mention this BULLETIN.

CONTENTS

INTERNAT. INST. OF AGRIC. *Internat. Review of Science and Practice of Agriculture* Year XIII, No. 10. Rome, October, 1922.

III. — LIVESTOCK AND BREEDING.

a) GENERAL.

PLANT DISEASES.

III. — Parasitic Diseases (Bacteria, Fungi and other Cryptogams.)

V. — Injurious Insects and other Lower Animals.

In quoting articles, please mention this BULLETIN.

CONTENTS

III. — LIVESTOCK AND BREEDING.

a) GENERAL.

PLANT DISEASES.

III. — Parasitic Diseases (Bacteria, Fungi and other Cryptogams.)

IV. — Weeds and Parasitic Flowering Plants.

V. — Insects and other Injurious Invertebrates.

EDITORIAL STAFF OF THE BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES.

Chief of Bureau: Dr. Jules-Michel Saulnier.

Editors:

Dr. Guido Borghesani, Chief Rédacteur.
Prof. Giulio Trinchieri, Chief Rédacteur.
Prof. Girolamo Azzi, Chief Rédacteur.
Théodore Bïéler, Lic. ès Sc. phys. et mat., Chief Rédacteur.
Paul Castellan Ing. Agr.
Dr. Francesca Dorio.
Margarite L. Yeo, Dipl. Hort. Sc. Oxford & Reading.

In quoting articles, please mention this BULLETIN.

CONTENTS

III. — Livestock and Breeding.

a) General.

b) Special.

IV. — Farm Engineering.

V. — Rural Economics.

VI. — Agricultural Industries.

PLANT DISEASES.

II. — Diseases not due to Parasites or of unknown Origin.

III. — Diseases due to Fungi, Bacteria, and other Lower Plants.

IV. — Weeds and Parasitic Flowering Plants.

V. — Injurious Insects and other Lower Animals

YEAR XIII — NUMBER 1 JANUARY 1922

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1 - **The Effect of a Variation in Milling on the Digestibility of Wheat Flours.** — HYGIENE
LANGWORTHY, C. F. and HOLMES, A. D, in *Proceedings of the National Academy of Sciences of the United States of America*, vol. 7, No. 4, pp. 119-123. Washington, April 1921.

The shortage in the World's food-supply in 1917 made the collection and correlation of data concerning human nutrition of the outmost importance and many questions were re-examined in the hope of providing additional data of value.

Extensive investigations into the chemical composition, digestibility and nutritive value of wheat and wheat products have already been made by European investigators and in the United States (1). Investigations made by the Office of Home Economics of the U. S. Department of Agriculture undertaken with the co-operation of the Maine and Minnesota Agricultural Experiment Stations included studies in the digestibility of wheat flours prepared in a variety of milling conditions from wheat grown in similar climatic, seasonal and soil conditions. The results obtained showed that the protein of white flour (72 % extraction) was 88.1 % digested ; that of entire wheat flour (85 % extraction) was 81.9 % digested, and that of graham flour (100 % extraction) was 76.9 %.

In 1917, the U. S. Food Administration requested the Office of Home Economics to obtain additional data concerning the relative digestibility

(1) U. S. Department of Agriculture, Office Expt. Stations Bulletin 85 (1900) ; 101 (1901) ; [illegible] ; 143 (1904) ; 156 (1905).

[Abstract No. 1]

of flours representing a series of extractions from the same lot of wheat. The flours studied were prepared from the wheat mixture provided to the flour-millers by the U. S. Grain Corporation late in 1917 and consisted of the following : choice hard spring (largely Marquis), 20 % — spring, 25 % — velvet chaff, 15 % — slightly smutty spring, 25 % — durum, 10 % — Kansas and Oklahoma, 5 %. The milling rates adopted were : 54-70-85-100 % of wheat or in other words the flours were those known in commerce as " patent ', " standard patent ", " whole wheat " and " graham ". The digestibility tests were conducted with healthy young men, of whom some were accustomed to much and others to comparatively little exercise : There were 139 of these tests and the experimental periods were from 15 to 25 days in length and subdivided and regarded as separate and successive three-day experiments. The diet consisted of bread, oranges, sugar with tea or coffee. The following table summarizes the results.

Summary of Experiments on the Digestibility of Wheat Flours.

Kind of flour used	Number of experiments	Amount of bread eaten per man per day	Digestibility of entire ration			Digestibility of Bread Protein	Digestibility of Bread Carbohydrate
			Protein	Fat	Carbohydrate		
		Grammes	Per cent	Per cent	Per cent	Per cent	Per cent
54 % flour	43	600	87.8	96.5	98.8	87.7	99.7
70 % »	42	564	90.1	96.1	99.0	90.1	99.9
85 % »	21	472	87.1	96.9	97.5	87.1	98.5
100 % »	33	663	84.2	93.9	95.0	84.2	94.4

Thus the maximum of digestibility was shown by the 70 % flour, that of the 54 % flour was slightly greater than that of the 85 % flour, while the digestibility of the 100 % flour was the lowest. The results are in accord with those obtained in earlier experiments. The fat content of the diet was equally well digested, digestibility being almost complete, except in the case of the 100 % flour, when it reached 93.9 % only.

The 54 % and 70 % flours did not tend to produce constipation ; the 85 % and 100 % flours produced a somewhat freer movement of the bowels but no marked laxative effect was noticed.

2 - **The " Bacteriophagous " Microbe** (1). — D'HERELLE, F., in *La Nature*, No. 2479, pp. 219-222. Paris, Oct. 1, 1921.

An account, for general use, of the present state of information with regard to the bacteriophagus microbe discovered by the Author, who makes the following statement :

(1) Several Studies on the bacteriophagous microbe were analysed in *R.* April 1921, No. 439 and *R.* April 1921, No. 399. — Others have appeared in the *Comptes rendus de la Société de biologie*, Vol. LXXXIV, 1921, pp. 3. (F. WOLLMAN). — 5 (L. MARTIN) — 275, 750, 751, 753, 755 (A. GRATIA) — 276, 278, 280, 745, 747, 748 (J. BORDET and M. CIUCA) — 336, 384, 538, 863, 908 (F. D'HERELLE) — 467, 468, 755 (J. MAISIN) — 798 (G. ELIAVA and E. POZERSKI.) — (F. D'HERELLE and E. ELIAVA) — 817 (R. BRUYNOCHE and J. MAISIN). (*Ed.*)

" The facts observed in bacillary dysentery are the following.

A sample of the dejecta are taken for each day from the onset of the malady till the end of convalescence. Each sample is mixed with broth and passed through a Chamberland filter: all the microbes which can be seen under the microscope remain in the filter, the filtered liquid is clear and remains so indefinitely if preserved aseptically; it is apparently sterile.

For the sake of clearness, I take a chance example from the notes on a series of experiments.

The case of Victor Ker was tested during a period of 30 days, giving 30 samples of dejecta filtrate, one for each day.

Thirty tubes of dysentery bacillus culture are taken and a drop of each of the 30 filtrates added to each tube and all the tubes submitted to a temperature of 37° C in the stove. After twelve hours the following results are reached.

Tubes 1-6, no change; the broth is turbid as in the case of a normal culture of dysentery bacteria.

Tubes 7-18, perfectly clear.

Tubes 19-30, turbid as tubes 1-6.

Hence a strange phenomenon is to be noted in tubes 7-18; the dysentery bacteria have been dissolved without leaving a trace. How has this been caused? It cannot be the drop of added filtrate. It is to be concluded that from the seventh to the eighteenth day the patient's dejecta contained some element which destroys and dissolves the dysentery bacteria.

If we now enquire whether there is any correlation between the state of the patient and the presence of the solvent principle in the excreta, we see that from the seventh day onwards the blood has disappeared from the stools and the patient's condition has rapidly improved; by the eighteenth day the cure was complete. The presence of the solvent principle has been coincident with the cure: an investigation of a large number of cases has shown that the phenomenon is constant, not only in bacillary dysentery but also in typhoid, fowl typhus and even in maladies without intestinal symptoms, such as hemorrhagic septicæmia in buffaloes and bubonic plague.

If the filtrate containing the principle which dissolves the dysentery bacteria is again examined and an infinitesimal quantity of the culture added instead of a drop — for example a thousand millionth part of a cubic centimetre, — after a few hours the bacilli are as completely dissolved as with a drop. What then is the nature of this bacteriocidal principle whose action is many thousand times more effective than any antiseptic, however powerful?

If a trace of the culture of dysentery bacilli which has become clear as a result of the action by the filtrate is taken and introduced into a new, very turbid culture of the same bacillus within a few hours this second culture becomes clear and all the bacilli are dissolved. If a trace of this second dissolved culture is introduced into a third, this is in its turn dissolved also and the series can be continued indefinitely: for example a trace of the 100th dissolved culture causes dissolution in the 1000th. Hence the principle which dissolves the bacteria reproduces itself and develops as a living germ."

If the culture of dysentery bacilli in the limpid state is examined under the highest form of microscopic enlargement, no microbe is visible. The principle which dissolves the bacteria is a microbe of extreme minuteness, which escapes the closest filtration and is invisible under the microscope, an ultra-microbe in a word. These ultra-microbes are enumerated in the following manner:

Ten cubic centimetres of a broth culture rich in dysenteric bacilli are taken to which is added the filtrate containing the dissolvent principle so diluted as to contain one fiftieth thousandth part of a cubic centi-

metre of the filtrate ; this is shaken vigorously and immediately a hundredth part of a cubic centimetre is exposed uniformly on the surface of a solid tube. After heating in the stove at a temperature of 37° C. a layer of bacilli will be found on the solid medium, interspersed with 50 small circular fields in which the bacilli are dissolved. Each field represents a focus for the dissolution of bacilli, that is to say an ultra-microbe originally developed. This method of enumeration is the basis of all the experiments which have enabled the Author to study the activities of the ultra-microbe and to determine its function.

The result so far obtained may be briefly summarized as follows :

The principle which dissolves the microbes is an extremely minute ultra-microbe : its volume might be regarded as equivalent to that of a molecule of albumen. It is named by the Author *Bacteriophagum intestinale* or more simply " bacteriophage " and is itself a dependent parasite only able to develop at the expense of living bacteria which it penetrates by means of its property of secreting dissolvent principles. It reproduces itself after penetration into a bacterium ; utilizing for its growth the substance dissolved from the bacterium, it forms a colony of 15 to 25 elements. The bacterium gradually swells, assumes a globular form and then bursts, thus liberating the young ultra-microbes, each of which in turn becomes parasitic on a fresh bacterium

There is only a single type of bacteriophagous microbe, which through habituation can become parasitic for a very large number of species of bacteria, quite possibly for all bacteria. Up to the present the Author has identified it in parasitic stocks for very different species : — the bacilli of dysentery, typhoid fever, plague and staphylococcus to name only typical bacteria of human diseases. The faculty possessed by the bacteriophagous microbe of becoming parasitic for different species of bacteria corresponds precisely with the acquisition of a " virulence " which can be enhanced or diminished *in vitro*.

The normal habitat of the bacteriophagous microbe is the intestine and the Author has found it in the contents of the intestine of all the healthy animals he has examined both vertebrate and invertebrate. Here it lives at the expense of the normal bacteria to be found in the host. When a strange bacterium is introduced into the intestine, the bacteriophagous microbe becomes habituated more or less rapidly according to conditions and becomes parasitical for the invading germ. If this germ is pathogenic, the fate of the individual attacked depends upon the rapidity with which the bacteriophagous microbe becomes habituated. If habituation is immediate, the disease aborts before producing any morbid symptom. If delayed, the disease declares itself and the period of delay determines the duration of the illness. Convalescence begins only at the moment when the bacteriophagous microbe gets the mastery of the bacterium and if habituation does not take place at all the victim succumbs.

The question arises why is habituation sometimes retarded or checked. The answer is that environment exercices an influence upon the struggle favourable to one or other of the contending germs. For exam-

ple the bacteriophagous ultra-microbe is more sensitive than the bacteria to the reaction of the environment ; it cannot resist a degree of alkalinity or acidity which the bacteria can withstand with practical impunity. There is also another element, primordial in character, which gives the other side of the question. The bacteriophagous microbe is capable of assuming the quality of " virulence " as against a bacterium, but the bacterium when attacked does not remain passive but defends itself and can acquire immunity. The stages of the struggle betwen the bacteriophagous microbe and the bacterium are precisely similar to the stages of the struggle between the bacterium and the higher organism on which it is parasitic. The disease bacterium secretes a toxin which acts upon the cells of the infected subject, which replies by developing an antitoxin. The bacteriophagous microbe secretes a dissolvent diastase, or lysine which acts upon the bacterium, which replies by developing an antilysine ; thus there is merely a descent in the scale of the contending entities.

Protection by the bacteriophagous microbe is not confined to affections of the intestine ; the ultramicrobe can also enter the circulatory system and function at any point in the organism. For example the author in cases of convalescents has succeeded in isolating and making cultures of bacteriophagous microbe stocks which dissolve the bacillus of bubonic plague.

Briefly the history of a case of infectious disease is a reflection of the process of the struggle which takes place in the organism between a disease bacterium and the bacteriophagous ultra-microbe.

But this is not all : every convalescent from a contagious disease carries in the intestine bacteriophagous ultramicrobes working against the disease bacterium, and distributes them with his excreta. He can thus " infect " his neighbours and immunity is as contagious as the disease itself. The author has frequently discovered that at the end of an epidemic all susceptible subjects who have escaped the contagion carry in the intestine the bacteriophagous microbe in the active state and in this way the idea of " contamination " by the bacteriophagous microbe has been brought home to him.

Thus the history of an epidemic is in the final analysis the history of a struggle between two active forces : the disease microbe, which at the beginning develops freely, and the bacteriophagous microbe whose virulence against the bacterium increases in the case of patients where conditions are favourable. Such patients recover, distribute the bacteriophagous microbe in active condition and the epidemic comes to an end when all susceptible individuals give it shelter in their organism. These facts have been demonstrated by studies of different forms of animal distempers such as fowl typhus, hemorraghic septicaemia of buffaloes and rat-plague : the two last diseases were investigated in the Far East.

Hence a new fact emerges : antimicrobian immunity is heterologous in the susceptible animal ; the defence of the organism is secured by an ultra-microbe, parasitical upon the bacteria.

But as has been seen this ultra-microbe can be cultivated *in vitro*

and it is therefore possible to obtain as many cultures as may be required. If the observations made are in fact accurate and a susceptible animal is assured of immunity from the moment when the bacteriophagous ultramicrobe becomes habituated to parasitism upon the disease-producing microbe which is trying to invade the organism, it ought to be possible to reproduce the phenomenon at will. In this case it will merely be necessary to introduce into the susceptible organism a culture of the bacteriophagous microbe which has become virulent for any particular bacterium to cause the organism to become immediately proof against the disease which it causes.

Experiments made in fowl typhus and hemorraghic septicaemia of buffaloes have in fact established this principle, for they have shown that ,—

a) in epidemic conditions a single injection of a minimum quantity of a culture of the bacteriophagous microbe active in relation to a given bacterium produced immunity from the disease caused by it from the moment of the injection.

b) in non epidemic conditions immunity was acquired only after an incubation period varying according to the dose injected. In the case of hemorraghic septicaemia in the buffalo immunity is attained after twenty days with a dose of a quarter of a cubic centimetre. After the injection of a single drop a buffalo weighing 250 kg. became immune in four days.

Experiments in connection with the curative properties of the ultramicrobe have also been made on similar lines in 100 cases of fowl-typhus and later in 7 cases of human bacillary dysentery. These have proved that the injection or ingestion of a minimum quantity of a culture of the bacteriophagous microbe, developed at the expense of the disease-causing bacterium, checks the progress of the disease at once, provided of course, that it is introduced at a time sufficiently near to its first onset to secure that the organic lesions are not of themselves severe enough to bring about a fatal issue, for the function of the bacteriophagous microbe is confined to the destruction of the bacteria. It has been noted above that at the end of an epidemic all the susceptible individuals who have escaped contagion are carriers of the bacteriophagous microbe destructive to the bacterium which causes the disease. This conception makes it possible to consider the possibility of a collective protection. It would seem that this purpose would be fulfilled by diffusing in the drinking water cultures of the bacteriophagous microbe in a state of activity, there being ample experience to shew that it is absolutely harmless for all living beings.

In this way it could be made certain that the bacteriophagous microbe destructive of the cause of the epidemic would be present in the organism of all susceptible individuals during the whole of the critical period.

What light is thrown on the phenomenon of phagocytosis by these new facts ?

A study of the phenomena of protection must deal with three different conditions of the subject :

1) The animal naturally resistant.

2) The susceptible animal that has acquired immunity either naturally following on an attack, or experimentally following a vaccine treatment.

The above are the two conditions which have been considered by METCHNIKOFF and his fellow workers. They have recognized that protection in these two cases is secured by phagocytosis. It still remains necessary to consider the means of protection for :—

3) The susceptible animal that does not, or does not as yet, enjoy immunity.

The two following questions require to be answered.

Susceptible animals exposed to contagion do not in all cases contract the disease : what are the means of protection possessed by those which escape ?

An animal attacked by a contagious disease of bacterial origin is cured and thus obtains protection : what are its means of protection between the onset of the malady and the moment when this immunity is established ? In fact why does the cure take place ?

Experiments upon the bacteriophagous microbe suggest the answer to these questions.

The heterologous immunity produced by the bacteriophagous microbe does not take the place of the homologous cellular immunity, for it functions at a time when the latter is not active ; the first is dominant in the susceptible animal, the second in the resistant.

AGRICULTURAL EXPERIMENTATION

3 - **New Institutes for Agricultural Experiment in Italy.** — STRINGHER. V., in *Atti della R. Accademia dei Georgofili*, Series V, vol. XVIII, No. 2, pp. 64-82. Florence, April 1921 (1).

An account of the establishment during recent years of Institutes for Agricultural Experiment, founded by various Agricultural Associations and placed under the general supervision of the Ministry of Agriculture.

The " Stazione agraria sperimentale " at Bari has been at work since 1919 : its main objectives are as follows :

a) The scientific study of the special problems of Agriculture in Southern Italy with particular reference to the application of physics, chemistry and biology thereto.

b) Methods of protecting crops from vegetable and animal pests.

c) The publication of practical information concerning crops and agricultural industries of special interest in Apulia.

The State, Province, Municipality and Chamber of Commerce of Bari all contribute to the maintenance of the Institute with a total annual contribution of 93 000 *lire*. The local authorities provided the building and site ; in addition the Ministry of Agriculture made a grant of 640 000 *lire* for initial capital expenses.

(1) See *R.* Oct-Dec. 1919, No. 1074 (*Ed*).

The " Istituto sperimentale di meccanica agraria " at Milan was opened on June 10, 1920 ; its chief duties, which are both agricultural and industrial are the following :

a) To carry out studies and trials of machines and machine-plant used in agriculture, agricultural industries, soil improvement and irrigation either at the instigation of the Government or other Public Administrative Bodies, the request of manufacturers, etc., or on the direct initiative of the Institute.

b) The preparation of tests and the collection and coordination essential elements in trials for juries at Competitions and Exhibitions agricultural machinery.

c) Laboratory and open air research work leading to conclusions likely to be of assistance in the scientific and technical development machines and machine-plants for agricultural industries.

d) The coordination of the work of the Institute with results obtained in similar institutions in other countries, by juries at Competitions and Exhibitions and by specialists, with reports thereon to the competent Ministries and to Institutions and other bodies interested.

e) To give technical advice with regard to machines, plant and agricultural industries.

The Ministry of Agriculture has made a grant of 100 000 *lire* for initial capital expenditure and allows 50 000 *lire* a year for maintenance the Province and Municipality of Milan each make grants of 10 000 *lire* annually. It has however to be recognized that, in order to carry out its functions on the lines laid down, the Institute will require much larger subsidies and these are likely to be forthcoming.

A Government Decree of June 8, 1920, established the " Istituto nazionale di genetica per la cerealicoltura ". Its duties are to conduct experiments to discover the best varieties of cereals for the different districts of Italy and to arrange for their distribution to the farmers. The Institute will have a total sum of about 8 500 000 *lire* at its disposal.

The Institute will have under its administrative and technical control

a) Phytotechnical stations with trial and initial multiplication plots for Apulia, Sicily and Latium (attached to the Institute) ;

b) Local observation and trial plots ;

c) Multiplication plots ;

d) Plots for the maintenance of pure seed lines with offices for distribution attached ;

e) A museum of genetics at Headquarters.

The technical work of the " R. Stazione sperimentale di granicoltura " at Rieti will be coordinated with that of the new Institute.

The " Istituto di allevamento vegetale per la cerealicoltura " was originally founded at the " Scuola superiore di Agraria " at Bologna and recognized by the Ministry of Agriculture on June 10, 1920, which assigned to it a total annual subsidy of 50 000 *lire*. The special duties of this Institute are as follows :

1) Work for the improvement of the most important types of cereals grown in Italy, particularly wheat and kindred varieties ;

2) To bring about a more effective and complete employment of improved varieties :

a) by encouraging and carrying out, in cooperation with local agricultural associations and individual farmers, trials for the purpose of delimiting the most advantageous zone of culture for each variety ;

b) by encouraging and directing as occasion arises the local seed production in each zone so that as a general rule each district may be in the position of raising on its own soil the means of reproducing the selected varieties which it requires ;

3) To carry out from time to time selective tests in an appropriate milieu, of common established varieties of cereals at the request, or on behalf, of a contributory agricultural association ;

4) To complete the phytotechnical studies of the pupils of the Higher Agricultural School of Bologna by means of an appropriate practical and experimental apprenticeship.

The " Stazione sperimentale di maiscoltura " was founded at Bergamo on March 7, 1920, for the purpose of the improvement of maize culture and is mainly engaged on the following studies :

a) The physiology of the maize plant ;

b) Native and foreign varieties, selection and crossing ;

c) The value of the main product (grain) from the point of view of preservation, crushing and grinding, as food for men and cattle, industrial use (cake, alcohol, etc.) and as a marketable commodity ;

d) The waste products (stalks, straw, etc.) and how to use them to best advantage ;

e) The rotation systems best adapted to the crop, fertilizers, preparation of the soil, sowing and methods of cultivation, irrigation ;

f) The main difficulties in maize-culture and methods of control ;

g) Means of preserving the crops, etc.

A capital expenditure of 240 000 *lire* has been incurred and maintenance subsidies amount to 35 000 lire.

The station will also be in a position to deal with problems of selection for other cereals and especially for barleys for malting, and in addition experimental work on deterioration in maize will be undertaken.

The " Stazione sperimentale di Risicoltura " at Vercelli was started in 1908, and reorganized in 1917. It derives an annual income of 39 600 *lire* in addition to the premises and land required for the special work undertaken which is as follows :

a) To initiate, encourage and control experiments and demonstrations with the object of improving rice culture on a scientific basis so as to increase the value of the crop both in quantity and quality and also to improve other irrigated crops grown in rotation with rice ;

b) To keep abreast of the economics of rice-culture both at home and abroad, as a source of information and guidance to be communicated to farmers and other workers concerned, for the benefit of Italian production ;

c) To make contributions to the solution of the hygienic and social problems connected with rice culture ;

d) To make known by means of suitable peripatetic instruction the results of experimental and demonstrational work.

Funds amounting to 3 800 000 *lire* have recently been made available for this station.

The Experimental Station which was started at Lodi in 1871 was developed in 1919 into the " Istituto sperimentale di Caseificio ". The main object of this Institute is to carry out scientific and technological enquiries into questions related to milk and its derivatives with reference both to its use as a food substance and also to the dairying industry in order to obtain precise and definite information. At the same time it will undertake experiments of all kinds calculated to establish the best technical results combined with the greatest economic advantages, and encourage the dissemination of modern ideas on the science and technique of milk production by means of occasional courses of instruction, conferences and publications. In addition to the half million *lire* allocated for capital expenditure, the Institute has a total annual subsidy of 50 000 *lire*.

The " Stazione sperimentale del freddo " annexed to the " R. Scuola superiore di Agricoltura " at Milan has been at work since July 1, 1913. Its functions include :

a) The examination, for purposes of comparison, of machinery, equipment and substances (especially non-conductive) used in the industry ;

b) The study of the application of artificial chilling, especially as regards the preservation of perishables and the treatment of agricultural produce ;

c) Enquiries into means of transport in cold storage and their organization from the point of view of food supply and problems of importation and exportation.

The Station has a total annual revenue of 18 000 *lire* together with a capital grant of 50 000 *lire* from the Ministry of Agriculture.

The " Stazione di batteriologia agraria " at Crema was instituted in 1914 and deals with the following questions :

a) The preparation and preservation of forage ;

b) The feeding of cattle from the point of view both of hygiene and production ;

c) The milk industry ;

d) Tobacco culture ;

e) The retting of flax and other plants used in the textile industry ;

f) The preparation and preservation of alcoholic beverages ;

g) The preservation of fruits, vegetables and animal products ;

h) Treatment by organic fertilizers ;

i) Microbial soil life with reference to its productivity and chemical constituents.

The Government makes an annual grant for maintenance of 30 000 *lire* and a group of local and district agricultural Associations makes a similar contribution. As a result of the contributions by different State

Departments and local Associations the Station is now definitely established and is about to spend 800 000 to 900 000 *lire* on the purchase of a farm with stallage for 50 to 60 cattle.

The " Stazione sperimentale di pollicoltura " at Rovigo was opened on June 28, 1917. The land and buildings and certain grants are provided by the Local Authorities and in addition the State made a contribution of 40 000 *lire* for initial expenditure and allows an annual grant of 25 000 *lire*. The scope of this Institution includes :

a) The improvement of the most suitable breeds of birds, both local and imported, by means of crossing and selection ;

b) The comparative study and the choice of breeds giving the best results as regard food value and egg production ;

c) The study of the most scientific and economical methods of breeding ;

d) The study of the diseases of poultry and the best means of prevention and cure ;

e) Instruction and propaganda by means of short courses at the Institute, conferences and practical leaflets.

f) All other forms of work and study, instructional and experimental, contributory to the economic development of poultry farming in Italy. Additional funds are to be allocated to the Institute by the Ministry of Agriculture.

Adequate grants have also been made to the following — the Laboratories of Agricultural Chemistry at the R. Scuola Superiore di Apicoltura at Milan and the R. Scuola superiore di Agricoltura at Portici ; the Laboratory of Chemical Agricultural Technology at the " R. Istituto Superiore agrario sperimentale " at Perugia, the Laboratory of Agricultural Chemistry at the " R. Scuola superiore di agricoltura " at Pisa and the independent Laboratories at Forlì and Udine.

In brief the Italian Government has, during the economic and financial crisis following on the war, made a liberal and comprehensive provision for Agricultural Experiment similar to that made when the first Institutes for experimental work in Agriculture were founded in Italy during the period from 1870 to 1872.

4 - Third International Congress of Household Economy Instruction, Paris, April 1922. EXHIBITIONS, MEETINGS, CONFERENCES

The International Federation for the development of Domestic Economy Teaching, which has its central Office at Fribourg (Switzerland), decided to hold in Paris, from the 18th to the 21st of April a 3rd International Congress of Household Economy Instruction with an Exhibition of equipment, material and methods. The two previous Congresses were held at Fribourg in 1908 and at Ghent in 1913.

A National French Committee has been formed in Paris for the local organization of this Congress with M. CHAMPETIER DE RIBES as Chairman and an office at 23 Rue Bertrand.

The following are the subjects for discussion at the Congress.

General Scope: Organization, science and means of simplification of household work.

First Section.

GENERAL POSITION OF HOUSEHOLD ECONOMY INSTRUCTION.

1) *Household Economy Instruction in different Countries since the Ghent Congress.*

A. *Position immediately before the war.*

B. *Position during the war.*

Increased activity of women in national life through replacing men called up for military service. Observations made under these headings.

a) How have Household Economy Schools been carried on and worked during the War?

b) Have they been subsidized by the State or Municipality?

c) How have Household Economy Schools adapted themselves to the special conditions and what special services have they rendered, both national and local?

d) How far have members of the staff assisted in making good the shortage in food and fuel during the war?

e) Have the respective Governments and Local Authorities appreciated the services rendered and in what form has appreciation been expressed? — General results — marked development of women's sphere in political, economic and social life.

C. *Position at present time.*

General reconstruction. — The part of woman and of Household Economy Instruction (from the point of view of the simplification of household work).

2) *Household Economy Instruction in the Primary School.*

How and when should Household Economy Instruction be given to girls in the Primary School?

Is any form of special equipment necessary for this Instruction in the Schools in which it is provided?

If so, what should it be for town and country schools respectively?

3) *Household Economy Instruction as an integral formative element in the education and instruction of young girls of all classes.*

Should Household Economy Instruction be compulsory in Girls' Secondary Schools?

How and when should Household Economy Instruction be given in Girls' Secondary Schools?

Should each School be specially equipped for this Instruction?

What should be the equipment for Town and Country Schools respectively?

Household Economy Instruction for boys.

4) *Correlation of Household Economy Instruction with home education.*

How to make parents appreciate the value of this Instruction?

5) *Correlation with Technical Education.*

6) *Professional Training for Household Economy Teaching.*

a) How should courses for the scientific training of Teachers of Household Economy be organized?

b) The importance of establishing a definite Teaching Service for Household Economy.

c) The Pedagogy of Household Science. Should the instruction be individual, in classes with definite lessons or under the general direction of the Teacher.

d) What should be the equipment for Household Economy Instruction in professional Training Colleges?

e) The careers and prospects of Students in Household Economy Training Colleges?

7) *Inspection of Household Economy Teaching. — Duties of the Inspectorate.*

Second Section.

TECHNICAL INSTRUCTION IN HOUSEHOLD SCIENCE.

8) *Rural Household Economy Schools.*

Ways and means of making Household Economy Instruction really effective in rural areas.

9) *Household Economy Instruction after the School age.*

Civic duties of young girls. — Peripatetic Teaching. Child nurture.

10) *Technical training of domestic servants in the family (with compulsory examination).*

Present trend in direction of professionalism.

11) *Inspection of Technical Instruction in Household Science.*

Third Section.

SCIENTIFIC QUESTIONS CONNECTED WITH HOUSEHOLD ECONOMY.

12) *Household Science at the University.*

Introduction of questions relating to Household Science into the research work in University laboratories.

13) *To what extent can Household Economy Schools assist in social betterment from the point of view of Working Class Housing, Food, Infant Hygiene, Cooperative Purchase and Consumption, High Prices and Adulteration?*

***

The general notice of the Congress is accompanied by an extract from the *Bulletin of the Swiss Union of Technical and Household Economy Mistresses*, No. 4, Fribourg, April 15, 1921, setting out the resolutions of the Congresses at Fribourg (1908) and at Ghent (1913) and dealing with the main questions on the Agenda for the Paris Congress. This extract may be summarized as follows:

HOUSEHOLD ECONOMY INSTRUCTION IN GENERAL. — As regards the place of woman and of Household Economy Instruction (as making

for the simplification of household work) the School should lay stress on the main lines to be followed and on the detailed organization of the work, showing how the various small actions in each branch can be distinguished and arranged in orderly sequence.

Household Economy Instruction in the Primary School. — Pupils must have the requisite development of intelligence and adequate elementary instruction. Organization must be based on local requirements and the special needs of each group of pupils.

The pupil should be instructed in the keeping of household accounts; in the country she should also be given a knowledge of the farm accounts which she will have to keep as mother of the family. At the same time she should have practice in making a ready reckoning of the net cost and nutritive value both of each dish and of each meal.

Household Economy work should not merely be grounded on knowledge derived from natural science courses, but practical household work should provide innumerable opportunities for the verification of scientific laws and incidental instruction in chemistry and physics.

Ideas on art should be suggested by the utensils, etc. in common use and the pupil taught to appreciate their beauty as well as the beauty of simple forms of ornament.

The equipment of a Household Economy School, whether in town or country, should as far as possible reproduce the home conditions of the majority of the pupils. The scheme of work and of the cookery course especially should be the main consideration. The school, even when in a town should give the pupil an idea of the economic and social importance of the cultivation of flowers and vegetables, and for purposes of experiment and practical work there should be a garden attached.

Household Economy Instruction as an integral formative element in the education and instruction of young girls of all classes. — Household Economy Instruction for persons above the School age should be given to girls who remain at school after the elementary school period (in secondary or higher schools, special and technical). It is a matter of importance that the subject should be included in the examinations which confer a certificate of capacity for Elementary School Teaching. It is desirable that it should be made a compulsory subject with such variations as the particular circumstances of each country may require.

Correlation of Household Economy Instruction with home education. — The home ought to assist the teaching by encouraging regular attendance and providing opportunities for the pupils to put into practice the lessons learnt at school. In order to popularize Household Economy Instruction Parents' meetings should be held and demonstration courses for working class women given. The Household Economy School should impart healthy ideas on the facts of life and inspire enthusiasm for simple tasks.

Correlation with Technical Education. — The geometric system (based on personal measurements) should be adopted in instruction in cutting out and dress-making.

Professional Training for Household Economy Instruction. — Instruction should be given only by a mistress trained in a special Training College. Admission to such a college should be confined to girls who have obtained the elementary School Teachers' certificate or its equivalent and the minimum duration of the course should be for a year. The course should include instruction in Science (physics, chemistry, natural history) limited to its application to household work and in so far as it tends to make the students discover the rationale of the various processes included in their work. Rudiments of medical knowledge (hygiene, physiology and practical medicine) should be taught simultaneously in connection with discussions on the chief bodily organs and their functions. The more general instruction should be given by the staff, certain branches, such as child nurture and hygiene (human and animal) being entrusted to specialists.

The following methods for providing the teachers with the means of improving their knowledge are suggested : conferences or study circles ; repeater or special courses : technical libraries. Criticism lessons also serve a very useful purpose.

The instruction both theoretical and practical, should be in groups and at the end of the course an examination should be held. The house work should be carried out, entirely if possible, by the students in training with the help of children in the last two years of the elementary school, working in groups under the orders of the students responsible and the general direction of the Principal in charge of the Household Economy Instruction. All the housework of the school which has educative value (maintenance of cleanliness and order, orderly and tasteful arrangement of furniture, general control of the work and conduct of the children) should be entrusted to the students themselves and carried out by them under the strict and regular control of the teaching staff.

The Household Economy Teachers' Training College can be more or less agricultural in character according to the special needs of particular countries.

TECHNICAL INSTRUCTION IN HOUSEHOLD ECONOMY. — The Household Economy School can be expected to serve to some extent as a beneficial influence in connection with rural depopulation and rural problems in general by giving women a high conception of their function, both social and occupational, as heads of the farm household.

Continuation School work should meet the needs of *a*) young girls on leaving the Elementary School ; *b*) wage-earning women such as domestic servants, factory and work-room hands, shop-girls, clerks, etc.

It is to be hoped that employers of labour will be willing to allow a Household Economy Class to be formed in their factories or workshops for the benefit of their young women workers or that at least they will grant full facilities to their women workers and clerks to attend local classes.

Peripatetic courses should be given where it is not possible to have a permanent school.

SCIENTIFIC QUESTIONS CONNECTED WITH HOUSEHOLD ECONOMY. — Household Economy Schools can help in social betterment from the point

of view of Working Class Housing, Food, Infant Hygiene, Co-operative Purchase and Consumption, High Prices and Adulteration. The subjects of Instruction will include, rational feeding and vegetarian cookery ; the campaign against Alcoholism, Tuberculosis and Infant Mortality ; how to market ; social and charitable work.

Finally among resolutions of a general character is included one urging that in all countries where Household Economy Teaching is left to private initiative, there should be a federation of Committees, each preserving its own individuality, in order that the work and the benefits to be derived from it may enjoy the stimulus of concerted action.

CROPS AND CULTIVATION

AL
:Y

5 - **Information Concerning the Amazon Region, Brazil.** — LE COINTE, P., in *Revista Commercial, Industrial e Agricola do Pará*, Year 10, No. 13, pp. 414-429, fig. 9. Belem (Pará), December 1920.

The immense basin of the Amazon, the typical region of *Hevea brasiliensis*, offers boundless sources of wealth to the planter and timber-merchant, but the adequate working of these vast forests depends upon two factors, a sufficient supply of labour and the skilled direction of experts in woodcraft. The colonisation of this territory is hindered by the climatic conditions, but their importance is often exaggerated. It must not be forgotten that the distribution of meteorological values differs considerably in the various sections of this vast region. Hence side by side with depopulated zones, where marsh fevers are rife, wide tracts of country are found which owing to the healthy climate are a pleasant dwelling-place even for the European settler.

The author gives an account of his study of the climate of the Amazon region, basing his remarks chiefly on data collected in the districts of Belem, Obidos and Manaos.

TEMPERATURE OF THE AIR. — The thermometric observations naturally give very different results according to the localities where they have been made. It is however noticeable that, generally speaking owing to the slope of the Amazon basin towards the Atlantic coast, the East and North winds find their way unhindered into and sweep right through the valley, and the great evaporation they produce on coming into contact with the damp forest growth, largely tends to prevent any excessive rise in temperature ; on the lower Amazon, the average annual temperature is never above 28° C.

In the town of *Belem* (Pará), uninterrupted observations have been made at the Goeldi Museum for twelve and a half years ; similar meteorological work was done in 1897 at the Secretariat of Public Works and at the Lauro Sodré Institute ; the general average readings recorded (in centigrade degrees) were as follows : January, 25.9 — February, 25.3 — March, 25.9 — April, 25.9 — May, 26.1 — June, 26.3 — July, 26.4 — August, 26.3 — September, 26.6 — October, 26.8 — November, 26.8 — December, 26.4 — *annual average* 26.2.

The monthly means for 3 ½ years of observations in the town of *Obidos* (Pará), on the Amazon, about 900 km. above Belem are as follows: January, 27.09. — February, 26.55 — March, 26.43 — April, 26.17 — May, 26.25 — June, 26.02 — July, 26.62 — August, 27.67 — September, 28.05 — October, 28.44 — November, 29.04 — December, 27.70 — *annual average* 27.17.

In the town of *Manaos* (Amazon) situated on the Rio Negro, a tributary of the Amazon 1574 km. above Belem, the thermometer readings are as follows: average annual temperature 26.8° C — maximum temperature (October 27, 1902) 37.5° C. — minimum temperature (April 28, 1902, 18.8° C — annual absolute deviation 18.7° C.

Thus, at any rate in the lower and middle valley, the weather is characterised by constant high temperatures with regular and slight variations. The variations, at Belem are in direct relation with the rainfall. In February which is the wettest month, the temperature is lowest, and November, the driest month, is also the hottest.

At Obidos and Manaos, the minimum temperature is registered in May-June, the thermometer falling through the influence of the " friagens ", cold winds that rush down from the Andes. Here again however the greatest heat comes in November, the month of least rainfall.

As one leaves the river-banks and ascends the course of the tributaries, the heat decreases, and the difference between the day and the night temperature increases.

At 100 km. to the north of Obidos on the Ariramba plateaux, at an altitude of 280 m., the heat is already tempered by the drier air and strong ventilation from the north-east. Further north again on ascending terrace by terrace, the great amphitheatre that rises perpendicularly from the river, the traveller finds a temperate climate in Brazilian Guiana, which with its fine natural pastures would offer every advantage to the colonist, were it not that the waterfalls interrupting the course of its rivers, and the total lack of roads, render all access to the country very difficult.

The upper part of the basin of the southern tributaries (Jurna, Purus, Madeira), is swept at certain times of the year (from March to June) by intermittent violent winds (southwest) coming from the Cordilleras which are still covered with snow. These winds are known as " Sur ", or " Friagem ", and produce a sudden fall in the temperature. According to the author, on the Madidi, a tributary of the river Beni (Upper Madeira), in Bolivia, the thermometer drops in a few hours from 38° C to 11° C. Owing to the sudden lowering of the temperature, the atmosphere becomes saturated with moisture and a thick fog obscures the sun and extends over the district. The " Friagem " wind arises on calm hot days, shortly after the sun has passed the meridian, and is preceded by a fall of the barometer (5 to 6 mm.). The wind blows for 3 to 8 days.

The effects of the Friagem can be felt though to a very limited extent as far as Ovidos and Manaos.

Temperature of the soil. — At Belem the soil temperature, at 1 metre below the surface, varies from 26° C. to 28.5° C From observa-

tions made at the Lauro Sodré Institute (from 1904-1907), the annual average temperature is 27.45° C. At a depth of 30 cm. the average is 27.91° C.

RAINFALL AND FOGS. — The changes of temperature are not sufficiently marked to make it possible to divide the year into seasons. There are however two distinct periods, the rainy and the dry. The North-East Trade Winds passing over vast ocean tracts heated by the tropical sun, carry periodically into the basin of the Amazon enormous masses of water-vapour which ascend the valleys as far as the eastern ramparts of the Corderillas.

The sky is rarely clear, being usually greyish-blue and the horizon is veiled by thick fogs. The average nebulosity is 5.35 at Obidos, 6.3 at Manaos and 5.3 at Belem. In the latter town, it is 6.9 during the rainy season (January-April) and 3.6 during the dry (August to November).

At Belem, the so called dry period is only relatively dry for more or less rain falls throughout the year according to the seasons. The rains begin at the end of December, and attain their maximum from January to April; the winter, as the rainy season is called, finishes in August. The driest summer months are September, October and November.

All the country to the east of Gurupa, which includes the "furos" district, the great part of the "island" zone, the south and south east of Marajo and the right bank of the Pará as far as the coast, have the general climatic conditions of the Tocantin zone though slightly modified by the vicinity of the ocean.

From the observations made from 1894 to 1911, at the Museum, at Belem, the rainfall in that town is distributed as shown by Table I.

TABLE I. — *Rainfall Distribution at Belem from* 1894 *to* 1911.

January	296 mm	27 wet days
February	360 »	26 » »
March	388 »	28 » »
April	320 »	26 » »
May	261 »	24 » »
June	195 »	22 » »
July	166 »	19 » »
August	119 »	16 » »
September	87 »	16 » »
October	80 »	15 » »
November	64 »	13 » »
December	159 »	20 » »
Totals	2486 mm.	252 wet days

The relative humidity of the air is always very high; the 10 years' average being: January, 92.3 — February, 93.08 — March, 92.5 — April, 91.5 — May, 89.1 — June 86.1 — July, 86.1 — August, 86.1 — September, 85.2 — October, 84.2 — November, 85 — December, 87.6 — *Annual average* 88.3.

TABLE II. — *Rainfall Distribution at Obidos.*

	Amount in mm.	Wet days	Relative humidity
January	124.3	21.8	80.76
February	173.2	20.2	81.25
March	316.9	21.6	84.74
April	225	23	85.34
May	155.1	18.6	83.69
June	93.8	12.6	79.33
July	49.3	7	73.66
August	14.4	4.5	69.26
September	63	5.5	70.80
October	67.5	5	65.00
November	77	5.2	62.49
December	113.3	12.7	78.77
Totals	1592.3	157.7	76.26

At Macapá on the northern bank of the estuary of the Amazon, the rainy season, which lasts for 8 months is clearly marked off from the dry season lasting for 4 months during which almost absolute drought prevails.

The same division of the year is met with on ascending the lower course of the great river, but the rainy season is reduced to 6 months and the amount of rainfall is correspondingly diminished. Table II gives the results of the observations made at Obidos during 4 ½ years.

On the lower course of the Amazon, the North-east wind ("vento geral"), brings the dry weather and the west and the south-west wind ("vento de cima"), bring the rain.

At Manaos almost the same conditions are to be observed as at Obidos. The averages for five years are given in Table III.

Travelling from Manaos towards the interior of the basin the relative humidity is observed to increase, until the saturation point is reached, and condensation takes place owing to the countless streams, lakes and swamps that cover this region. At Porto Velho on the river Madeira, the rainfall already amounts to 2640 mm., distributed as follows : January, 373.8. — February, 338.8 — March, 330.2 — April, 255 — May, 139.2 — June, 52.8 — July, 17.8 — August, 34 — September, 142.2 — October, 240 — November, 328.1 — December, 386.8.

On ascending the course of the Purus, the climate becomes continually damper and the rainfall increases ; the amount of water falling annually at Tefé is already double that falling at Obidos ; at Pebas, the rainy season lasts nearly the whole year. From this point however the rainfall continues to diminish ; at Iquitos (Peru), the average temperature is 4.8, the relative humidity 83, and the total rainfall 2840 mm. ; August is the driest month. Finally Cordillera de los Andes, the Western boundary of the basin is reached ; there the large masses of water vapour which pass up the great river valley from the Atlantic Ocean are condensed in the form of the rain that incessantly beats upon the eastern slopes of the mountain chain and the snows that cover its lofty summits. This condensation is so complete, that almost absolute dryness prevails on the other side of the crest on the Pacific slope.

Other Meteorological Phenomena. — In spite of the excessive humidity fogs are somewhat rare owing to the constantly high temperatures; they are however occasionally to be seen in the early morning in April and May. Little dew falls on the deforested land of the lower reaches of the river but heavy dews are common in the interior of the country. Violent hurricanes and sudden gusts of wind are of rare occurrence. The atmospheric pressure like the temperature is subject to slight and regular variations; it attains its maximum in the morning and diminishes progressively during the day.

TABLE III. — *Distribution of Rainfall at Manaos.*

	Amount in mm.	Wet days	Relative humidity
January	240	22.7	82
February	248	20	81
March	296	19.6	83
April	202	15.6	82
May	135	14.6	82
June	43	4	77
July	80	4.6	76
August	51	4.3	74
September	38	7	73
October	45	12.3	72
November	30	10.3	71
December	225	19.3	78
Totals	1 057	154.3	77.6

The degree to which the Amazon climate is healthy depends largely upon all the factors discussed above and varies considerably in different parts of the immense region. The climate is distinctly unhealthy in the interior, but continues to improve in the riverine zone of the middle and lower portion of the great river (1).

6 - **Influence of Climate on the Fixity of Hybrids from the Standpoint of the Segregation of Characters in the Second Generation.** — See No. 20 of this *Review*.

(1) On the other hand, the progressive draining of the interior (sertão) and systematic cultivation will gradually bring about the disappearance of the swamps and in consequence greatly increase the salubrity of the region. As Dr. Deoclecio DE CAMPOS, Delegate of Brazil at the International Institute, has informed us, the district of Belem — in the low-lying district of the estuary of the Para — now enjoys a very healthy climate, owing to the drainage operations that have been carried out and to the energy of the special Sanitary Service (directed by Professor Osvaldo CRUZ), which has completely freed the town from mosquitoes. (*Ed.*)

7 – **Researches on the Specific Gravity of Certain Soil Constituents from the Point of View of the Fineness of the Soil Particles.** — NOLTE, O. (Landwirtschaftliche Versuchsstation zu Braunschweig), in *Internationale Mitteilungen für Bodenkunde*, Vol. XI, Parts 3-4, pp. 117-118. Berlin, 1921. SOIL PHYSICS

In theory it might be expected that the finer a body is, the less should be its specific gravity and this has again been proved by the author as regards certain typical soil constituents. He determined, with the help of a pycnometer, at 17-19° C, the specific gravity of fractions separated by mechanical analysis, estimating their density when air-dried at 100° C, and calcined, as compared with the specific gravity of water at 4° C. By this means as regards the precipitated silicic acid and kaolin, perceptible differences were found between the specific gravity of the fraction tha was precipitated in less than 24 hours, and the fraction deposited subsequently; these differences showed themselves at the 2nd and even the 1st decimal place. On the other hand, in determining the chemical composition of fractions of a stiff clay deposited in 24 hours, and after this time had elapsed, it was found that not only some of the colloidal portion remained in suspension, but also that there were great differences in their composition; thus the silica fell from 56.45 to 53.2 and 53.1 %; the alumina rose from 37.26 to 40.9 and 42.0 %; and the sesquioxide of iron from 1.84 to 2.3 and 2.5 %; the amount of lime, magnesium, and sodium varied; on the other hand, the potassium content increased considerably, from 0.24 to 0.8 and 1.2 %; oxide of titanium was only present in the intermediate fraction. The variation of the specific gravity of the portions obtained by means of more fractional deposition is characteristic, as is seen from the following Table:

Specific Gravity	Fraction precipitated				
	Before 100 seconds	After 100 seconds	After 15 min.	After 2 hours	After 24 hours
Expressed in relation to air dried material	2.467	2.470	2.492	2.482	2.317
Expressed in relation to material dried at 100° C	2.626	2.615	2.640	2.638	2.497
Expressed in relation to calcined material	3.317	3.115	3.017	3.048	3.008

This shows, that there is a considerable difference between the finer particles and the coarser ones, which do not vary perceptibly.

8 – **Effect of Temperature Upon the Absorbent Properties of Soils.** — STOQUER, in *Comptes rendus de l'Académie des Sciences*, Vol. 173, No. 17, pp. 731-733. Paris, October 24, 1921.

Agricultural soils experience great variations of temperature. In the neighbourhood of Paris the difference between the monthly averages of the same soil in July and January has been found to amount to 24.4° C

at the surface and to 19.3° C at a depth of 0.25 m. (FLAMMARION). Dr GASPARIN found a difference of 3° C at Orange.

The author wished to ascertain whether such variations had any effect upon the soil's power of fixing certain fertilising substances. He selected 4 soils differing in composition and studied their capability of absorbing sulphate of ammonium at 0° C, 16° C, 35° C and 55° C.

The experiment was carried out as follows: an amount of soil equivalent in weight to 100 gm. of dry soil was introduced into a flask, together with a total volume of 250 cc. of a very diluted solution of ammonium sulphate. The flask, which was kept in a bath at a constant temperature, was well shaken at the beginning and was afterwards shaken every 15 minutes for 1 hour. In order to clarify the solution, the flasks were left for 3 hours in the bath at the same temperature. A portion of the clear liquid was decanted and the ammonium present determined by distillation in the presence of magnesium. From the result obtained, the amount of ammonium fixed by the soil is estimated.

The total results are given in a Table from the study of which the following conclusions can be drawn :

1) The absorbent power always increased with the concentration of the solutions. This confirms an already well-known fact.

2) Under the conditions of the experiment, the absorbent power was sometimes negative (that is to say, the soil gave up some of the ammonium to the solution), or even sank to zero (when the solution contained the same amount of ammonia as the given soils). This occurred, within the limits of the temperatures studied, in the case of the first three soils with a 0.02/1000 solution, and in the fourth (garden mould), with a 0.08/1000 solution.

3) All the soils gave up ammonium to the distilled water (as was to be expected), and the amount yielded increased as the temperatures rose.

4) The absorbent power of the soil, as regards sulphate of ammonium decreased when the temperature was raised.

5) At temperatures that easily occur in soils, some are able to yield up their ammonium to 0.02/1000 and stronger solutions. These soils are not very poor in ammonium, and may have received a dressing of ammoniacal fertilisers. In certain circumstances, the amount of ammonium removed from the soil (without even being converted into nitrate), by the percolating rain-water is perhaps larger than is generally supposed.

The opinion is gradually gaining ground that soil solutions, in spite of their low content in fertilising substances, exercise a great influence upon plant nutrition. These solutions, as is seen from what has already been said, are richest in ammonium at the warmest periods, which is just when plant growth is most active ; hence we may suppose that some correlation exixts between the two phenomena.

9 – **Relation between the Nitrogen Content of the Soil and the Yield of Indigo in India.** — See No. 50 of this *Review*.

10 – **"Taungya" Cultivation in the Shan States, Burma, and Methods of Soil Treatment Recommended.** — THOMPSTONE, E. (Deputy Director of Agriculture, Burma), in *The Agricultural Journal of India*, Vol. XVI, and Pt. 3, pp. 251-264, Pt. 4, p. 396-405. Calcutta, May-June 1921.

The "taungya" system of cultivation as practised in the Shan States, Burma, and elsewhere, has been the subject of official investigation for many years, chiefly on account of the enormous amount of damage done to forest areas and the heavy destructions of timber. The system includes the cutting down of the jungle growing on the hillside, lopping off any branches of the trees and heaping these up with the brushwood, etc. round the stumps and then firing the whole. This operation takes place during the dry weather (February to May). Subsequent cultivation depends upon the slope of the ground and often the use of a hoe is the only implement possible on the steep hillside.

After burning, the heaps are allowed to cool and if the crop grown is potatoes, the setts are planted in mounds from 1 to 3 setts in each; for other crops the heaps are spread by hand and the seed is sown broadcast. The principal crops grown in the Myelat are paddy and potatoes with an occasional crop of sesamum. Other crops grown are maize, ginger, groundnuts, sweet potatoes, gourds, opium, cotton and several kinds of beans.

The land is cultivated from 1 to 3 years (rarely 4) and then allowed to lie fallow for a considerable period. The actual "taungya" process is varied somewhat according to locality, conditions of fuel supply, etc.

The cultivator often attributes the success of his "taungya" crop to the destruction by fire of insects and fungi, and his failure after 2 or 3 years, to the return of these pests. However, investigations have shown that the probable effect produced can be traced as follows: — The young crop first makes use of the ammonia directly produced by the heat and later of that produced by the increasing number of bacteria. This continues till the crop is harvested, after which the production of ammonia is lessened by its accumulation (which checks the activities of the bacteria) in the soil, and later by the drying of the soil which will eventually arrest the process and check the multiplication of both classes of micro-organisms for the period of the dry season. At the break of the second rains the soil bacteria still retain the upper hand, but before the season's crop has been harvested the destructive organisms are rapidly gaining ascendancy, and before the dry season again comes round, the increase is marked, at the expense of bacteria. Once the original state of equilibrium is fully established between the two classes of organisms, the effect of the burning will have disappeared and the soil will have returned to its previous natural state, which on account of its poverty in lime and organic matter will entail unprofitable crop production over very large areas.

The results of practical field experiments strongly support this theory, and the ultimate aim of all "taungya" investigations has been to bring and under permanent cultivation, to put a stop to this destructive method and thus to induce the people to settle down on holdings of reasonable size with consequent substantial benefit to the country.

Results obtained at Yawnghive and Hsumhsai (Burma) suggest a simple and practical solution of the problem and the author here describes in detail a few typical cases.

There are obviously two ready substitutes for the heat (1) now being so laboriously applied, viz. lime and organic manures, small dressings of either have given more productive results and seem to be more lasting in their power than an ordinary " taungya " burning. The following examples demonstrate this fact :— The average increase in wheat yield on land to which lime was applied at the rate of 6000 lb. per acre, amounted to 273 lb. per acre (120 %) on land that had been cultivated for one year without previous burning, and an increase of 3440 lb. per acre of maize is reported on old " taungya " land. Corresponding results were obtained with *Phaseolus lunatus, P. calcaratus, Cajanus indicus, Cicer arietinum, Polygonum Fagopyrum*, etc.

As regards organic manure, in every case so far tried, the benefit derived from unburnt manure proved to be greater than that brought about by burning an equal quantity of manure. The following figures show also the advantage of planting potatoes in drills.

	Yield of tubers lb. per acre	Yield of grain lb. per acre
1919-20. In drills . . . Manure unburnt	9620	1200
» » . . . Manure burnt . .	6960	900
» » . . . No manure . . .	2800	nil
Hill method. . Manure unburnt	4000	—
» » . . Manure burnt . .	3540	—

These results were obtained without the aid of lime, but a combination of lime and manure gave also very striking results. (Lime had been applied 2 years previously, 5000 lb. per acre).

	Yield of potato tubers lb. per acre	Yield of grain lb. per acre
Manure and lime	8780	1960
» (without lime)	6160	520

Some of the older plots that have so far received neither lime nor manure have however still maintained their yields by good cultivation and rotations, and leguminous crops have been grown with success.

The author considers that liming, manuring and good cultivation, combined with a proper system of rotation can make continuous cultivation

(1) See *R.* Jan. 1913, No. 14, and *R.* June 1913, No. 646. *(Ed.)*

much more profitable than the present methods of shifting from place to place. The natural advantages for agriculture and the evident future possibilities for the Shan States make the need for experimentation extremely important.

MANURES AND MANURING

Experiments in Liming in the United States and in Canada. — I. HARTWELL, B. L., Liming with High-Magnesium Versus High-Calcium Limes, in *Agricultural Experiment Station of the Rhodes Island State College, Bulletin* 186, pp. 19. Kingston, R. I., May 1921. — II. MCCALL, A. G., The Comparative Value of Different Forms of Lime, in *The University of Maryland Agricultural Experiment Station Bulletin* 242, pp. 157-166. College Park, M. D., January 1921. — III. SHUTT F. S. (Dominion Chemist), Lime in Agriculture, in *Dominion of Canada, Department of Agriculture, Dominion Experimental Farms, Division of Chemistry, Bulletin* 80, pp. 16, revised. Ottawa, Ont., May 1921.

I. — Experiments to determine the liming effects of high calcium and high magnesium limestones, as well as of their burned and hydrated products.

The tests were carried out on permanent experiment plots of silt loam which were ploughed in 1893, and cropped with maize until 1899, after which various crops were grown till 1909, when the present experiments were begun. No lime, manure or fertiliser had been previously used. The first application of lime was made in 1909-1910, the amount used being sufficient to neutralise the same quantity of acid. The second and third applications of lime were made in 1914 and 1916. The latter completed the neutralisation of the soil acidity when, judging from the influence of the carbonated water, the speed of reaction of the limes would decrease in the following order: Magnesic hydrate, calcic hydrate, calcic limestone, magnesic limestone. From 1909 to 1921, the crops were mixed; hay, maize, potatoes, etc. No farm manures were used, but chemical fertilisers were usually applied so liberally that the liming materials were expected to act as neutralisers only and not as sources of plant food.

Beginning in 1917 the proportion of magnesium to calcium was increased by using in the mixture low-grade sulphate of potash and double superphosphate.

In 1920 the ratio of magnesium oxide to calcium oxide extracted from the soil by carbonated water was about $\frac{1}{7}$ from the plots receiving the calcic limes; $\frac{1}{1.7}$ from those receiving the magnesic limes, and $\frac{1}{2.2}$ from the unlimed plot. The yields were equally satisfactory whether the ratio was $\frac{1}{7}$ or $\frac{1}{1.7}$. In 1917 the ratio of magnesium oxide to calcium oxide in dried endive was respectively $\frac{1}{1.1}$ to $\frac{1}{1.5}$ with the plots that had received magnesic hydrate and limestone; from $\frac{1}{2.2}$ to $\frac{1}{3}$ in the case of the plots given calcic hydrate and limestone, and $\frac{1}{2.8}$ in the control plot without lime.

The humus content and loss on ignition indicate slightly less organic matter in the soil to which the hydrates instead of the limestones had been added. It can scarcely be concluded with certainty that the different limes have been accompanied by a change in the nitrogen content of the limed soil as compared with that of the unlimed soil, although the percentage of nitrogen is slightly higher where magnesic limestone was used. The unlimed plot was decidedly acid as compared with the limed plots, but it was the only one from which aluminium was extractable by certain normal salt solutions, and by carbonated water.

Certain sensitive crops have been greatly benefited by the liming; the beet yield for instance was frequently increased sixfold. Even these crops did not however react to the liming in such a way as to warrant generalisations concerning the specific effects of the different kinds of lime. Practically like effects may be generally expected whichever of the four forms is used, from an application having a given neutralising equivalent, that is, based upon the percentage of magnesium oxide multiplied by 1.4, plus the percentage of calcium oxide, provided that the limestones are sufficiently fine to pass through an 80-mesh sieve, and that the hydrates are used with the ordinary precautions.

II. — Lime is the key to soil fertility building, since the economic use of both manure and commercial fertilisers is dependent upon the lime supply of the soil.

The author tested the value of several lime-bearing materials in 3 different parts of the State. In one case, he compared the effect of : 1) burnt lime ; 2) burnt oyster-shell ; 3) shell marl ; 4) pulverised raw shell. The shell marl gave the highest yield of wheat and hay while the pulverised shell produced almost as much wheat and hay and a larger amount of maize. It should be mentioned that the marl contained nearly 3 % of potash which may account for its superiority.

In another experiment, a comparison was made between the effects of pulverised raw oyster shell, burnt oyster shell, pulverised raw limestone and burnt limestone ; the total average increase on the two plots during seven years as compared with the control plot, expressed in dollars per acre was 78.43 for the pulverised oyster shell, 73.85 for the burnt oyster-shell, 77.60 for the pulverised raw limestone, and 77.05 for the burnt limestone ; thus the differences between the effects of the various forms of lime used are negligible. In another experiment with lucerne, it was found, that raw pulverised limestone gave better results than raw oyster-shell lime, burnt limestone and hydrated lime.

In conclusion, the author advises agriculturists to determine whether their soils need lime and the amount required.

III. — The practice of liming has been sometimes encouraged and at other times discountenanced, which shows that if lime must be used it should be applied in moderation. The author described the experiments made of recent years by the Chemical Division of the Organisation of the Experiment Farms of East Canada. These have proved that in many

laces, the yield has been increased by liming, especially in the case of overs which form the basis of profitable agriculture.

In one experiment on clayey-sand the application of 672 kg. of potassic ertiliser per hectare which supplied 22.4 kg. of nitrogen, 44.8 of phosphoric cid, and 56 kg. of potash, and was spread before oats were planted, pro-uced in 1914, 51.57 hectolitres of grain per hectare. Another plot treated n the same manner, but to which 2240 kg. of ground limestone was applied, roduced 59.58 hectolitres per hectare (or 8 hectolitres more than the first lot). The second year of the rotation, the unlimed plot bore 55.5 uintals of clover and timothy-grass hay, whereas the limed plot yielded 3.8 quintals or 28.3 quintals more.

In another experiment two series of parallel plots on soil similar to he preceding, were dressed at the beginning of each rotation in the autumn vith 50.2 quintals of ground limestone, and in the following spring each of he series was given a different manure. In 1919, two three-year rotations of potatoes, cereals and clover gave the final results set forth in the follow-ng Table.

Leaving out of account the evident effect of the dung, these data show hat the lime stimulated the action of the fertilisers and their residues in ach three-year rotation. The effect of ground limestone is especially oticeable in the case of grasses particularly where basic slag was applied.

Average Yield per Hectare.

Ist Rotation (1914-16)	Potatoes 1914	Oats 1915		Hay 1916
		Grain	Straw	
	hectolitres	hectolitres	quintals	quintals
Control	50.31	27.36	18.1	8.06
Limestone alone	60.84	29.52	18.7	12.43
Chemical fertilisers alone	76.02	28.53	20.4	7.39
Fertilisers and limestone	86.04	34.56	24.6	16.73
IInd Rotation (1917-19)	Potatoes 1917	Wheat 1918		Hay 1919
		Grain	Straw	
	hectolitres	hectolitres	quintals	quintals
Dung alone	226.62	17.55	22.2	29.57
Dung and limestone	282.06	26.82	25.3	45.81
Dung and chemical fertiliser	263.16	20.93	22.4	35.01
Dung, fertiliser and limestone	296.37	27.18	29.4	55.17

In an experiment on sandy soil, where a comparison was made between unlimed plots and others to which 5 tons of limestone per hectare had been applied, the average yield of seed per hectare was for 3 varieties of barley 10.58 and 43.68 respectively — for 5 varieties of oats, 100.12 and 113.57 — for 4 varieties of wheat, 36.12 and 46.04 — for 4 varieties of peas, 39.14 and 79.30.

In Canada, some of the commonest calcareous substances are marl,

or shell-marl, with a lime content varying from 30 to 90 %. The author advises the application of from 5 to 12.5 tons of dry marl for light and clay-sandy soils, and of 25 to 75 tons for heavy clays. The land should be ploughed and harrowed both in the spring and autumn. If marl is to be obtained, there is no need to get ground limestone or lime, for marl is cheap, improves the soil greatly and increases the yield.

This Bulletin concludes with a series of analyses of the calcareous substances suitable for agricultural use that are to be procured in the different provinces of Canada.

12 - **The Present Condition of the Superphosphate Industry in Japan.** — ISHIKAWA I., in *Kôgyô-Kwaiata Zasshi* Vol. XXIV, No. 7, pp. 700-717, figs. 5. Tokyo, July 1921.

In Japan, the greater part of the people are engaged in farming, and the capital invested in agriculture is three or four times higher than in the manufacturing industries. The area of land cultivated for 2 000 years is as follows:

Rice-fields	3 010 000 *chobu*
Under other crops	3 070 000 »

(1 chobu = about 2.45 acres).

The rate of increase in population amounts annually to 1.0 per cent. while that of rice-fields, and other fields under cultivation is only 0.4 per cent. in each case. Therefore, if Japan does not make efforts to intensify production by using chemical fertilizers, the food problem will become serious.

The fertilizers used are bean cake, rape cake, cotton-seed cake, pressed herring, pressed sardine, bone meal, Chili nitrate, ammonia sulphate, superphosphate and mixed fertilizers. In 1919, the total cost of these fertilizers (with the exception of Chili nitrate) was estimated at 240 000 000 *yen* (1 *yen* = about 2 shillings at par), of which 10 % was superphosphate and 60 % bean cake.

The present condition of the superphosphate manufacturing industry is as follows:

Number of companies	15
Number of factories	28
Productive capacity	25 000 000 *yen*
Nominal capital	72 000 000 »
Capital paid	53 000 000 »
Current capital	111 000 000 »
Permanent investment account	28 000 000 »

The number of sulphuric acid plants, which are closely connected with the superphosphate industry, is 53 and most of them are in the Tokio and Osaka districts.

In 1888 the first artificial fertilizer company in Japan was established. Since the China-Japanese and Russo-Japanese wars, as a result of the prosperous conditions of the market, new companies were established. When trade became dull, amalgamation took place, so that the present companies rest on a stable basis and are reliable.

The demand for mineral phosphate is 300 000 tons yearly, while the home production is chiefly from Rasa Island ; but its maximum production amounting to 110 000 tons per annum only, Japan must continue to import the raw material. Angaur Island has lately come into the possession of Japan and it will somewhat neutralize this disadvantage ; its reserve, however, is said to be only 2 000 000 or 3 000 000 tons. Probably more mineral phosphate will be supplied from the province of Kiangsu (China), and from Hirata Island, south of Hainan Island.

As to sulphuric acid, there are 124 lead chamber and tower system plants and 8 plants employing the contact process. The total capacity for production is estimated at 1 150 000 tons of 50° Bé. acid per annum, the actual amount being 900 000—950 000 tons, 500 000—550 000 tons of which are used to produce superphosphate.

In Japan, superphosphate is mainly packed is straw bags, even though a small amount of burlap bags is used. The straw bags are mostly made by hand as farmers' by-products and the old bags are re-used by them for many purposes. Therefore packing by machine is not, for the time being, considered desirable. The present production of superphosphate amounts to 15 000 000 bags (1 bag contains about 83.3 lbs.) per annum, and if the time comes when more superphosphate is used for every area unit, *e. g.*, 30 bags per 1 chobu, 30 000 000 bags will be required in Japan. Moreover, China is thickly populated and does not at present use any artificial fertilizer (1). When it does come into use in China large quantities can be supplied from Japan. Consequently there are limitless prospects for the superphosphate industry in Japan.

3 - **Relation of Organic Matter and the Feeding Power of Plants to the Utilisation of Rock Phosphate.** — BAUER, F. C., (Agricultural Experiment Station, University of Wisconsin), in *Soil Science*, Vol. XII, No. 1, pp. 21-39, tables 9, bibliography of 45 works. Baltimore, M. D., July 1921.

The processes accompanying the decomposition and the feeding power of plants are undoubtedly important factors in the utilisation of rock phosphate. Experiments were planned in which common forms of organic matter were used with rock phosphate and in some cases provision was made for the removal of the soluble phosphorus and calcium in order more nearly to imitate field conditions in this respect. The soil medium consisted of either sand or soil, the former contained no soluble phosphorus. Experiments were made as follows : *a*) rock phosphate mixed with several forms of organic matter in sandy soil with no provision for the removal of phosphorus as it became soluble ; *b*) in similar mixtures provision was made by leaching and *c*) by upward moving capillary water, both for the removal of phosphorus as it became soluble ; *d*) study of the solvent effect of organic matter extracts with and without carbon dioxide on rock phosphate ; *e*) pot culture experiments, also made to ascertain this effect and to test the feeding powers of plants in relation to the utilisation of rock phosphate and felspar. The results may be summarised as follows :—

(1) See *R.* Sept. 1920, No. 889. (*Ed.*)

1) Experiments (*a*) (*b*) (*c*) and (*d*) failed to show a solvent effect o the decaying matter on rock phosphate, and in confirmation of result obtained by other investigators there was evidently a gradual decrease in the amount of soluble phosphate. The failure of the experiments to show an increase in the availability of rock phosphate was probably due to the fact that when organic matter such as was used (in this case, finely pulverised air dry buckwheat hay, sweet clover hay, alfalfa hay, soybean hay, mammoth clover hay, maize stalks, oat straw and chopped green buckwheat and sweet clover) decomposes, sufficient bases are liberated along with the acids that are formed, to neutralise the acids and prevent their action on rock phosphate. When mixtures of rock phosphate and organic matter are applied to soils, the conditions are different because of the capacity of soils to take up basic material, especially if they are acid.

In some cases mixtures of organic matter and rock phosphate applied in pot cultures produced increase in growth of maize over that produced by either the organic matter or rock phosphate when used alone. The phosphorus in the organic matter was readily available to growing maize. The organic matter furnished phosphorus to the seedling and thereby promoted growth which may have enabled the plant to feed more strongly on the rock phosphate or the rock phosphate may have been made more available by the chemical and biological processes accompanying the decay of the organic matter.

A study of the growth of 15 different plants on rock phosphate in sand cultures showed a wide variation in the amount of dry matter produced. The crops tested were red clover, sweet clover, wheat, oats, maize, timothy, soy beans, rape, alfalfa, rye, buckwheat, red top, red sorrel, mammoth clover and alsike clover. Tables show the average yields of dry-matter of the tops, roots and plants as a whole, the proportion of roots to the whole plant when grown with rock phosphate, and the percentage growth made with rock phosphate compared with that made with acid phosphate are recorded ; also the phosphorus and calcium content of plant tops and acidity of leaves, stems, and roots of plants grown with acid cultures with no potash, soluble potash and felspar potash.

Results show that there was quite a wide variation in the growth of the different plants with rock phosphate used at the rate commonly advised for field practice. Sweet clover and red sorrel produced the largest proportionate increases of dry matter and red clover the smallest. The increases of the former were about 3 ½ times greater than the latter. Sweet clover possesses remarkable feeding powers relative to rock phosphate and felspar and is well suited to rotations for their utilisation. With the exception of sweet clover which gave a slight increase, all the plants analysed showed somewhat distinct decreases in the percentage content of phosphorus when grown on rock phosphate as compared with acid phosphate. In general, neither the percentage content, nor the total amount of phosphorus in the plant tops was related to the amount of plant growth made with rock phosphate.

The acidity values of the juice of the leaves, stems and roots varied considerably with the different plants. In general the juices were more acid when grown with acid phosphate than with rock phosphate.

The possibility of growing crops of high feeding power to supply organic matter and available phosphorus in rotation with crops of low feeding power is a question of considerable practical importance in the utilisation of rock phosphate.

14 - **The Effect of Basic Slag upon Grassland and the Subsequent Crops.** — OLDERSHAW, A. W. (Agricultural Organiser for East Suffolk), in the *Journal of Agricultural Science*, Vol. XI, Pt. 3, pp. 288-292. Cambridge, July 1921.

Two plots of grassland, each 1 3/4 acres in extent, on a poor type of chalky boulder clay, were fenced off with wire netting; one was reserved for control purposes, and the other received a dressing of 10 cwt. per acre of basic slag, and a second dressing of a similar nature 8 years later. After 12 years of regular sheep grazing, on analysis of the first and second 9 inches of soil, the basic slag plot was found to contain 500 lb. of nitrogen per acre more than the unmanured plot.

The following year the plots were mown, ploughed up, and drained and sown with legumes and wheat successively, with dressings of superphosphate and sulphate of ammonia. The turf on the "slag" plot was very thick, and the yield was fairly high probably due to the thick growth of wild white clover. The increase in nitrogen as compared with the unmanured plot is only about 10 % whilst the increase in crop is much larger. It appears likely that the nitrogen assimilated being of more recent origin, would be more easily available to plants than the original nitrogen reserves of the soil. It is likely also that the extra plant residues left on the slagged plot, have a considerable influence on the mechanical condition of the soil and on its humus content. It is well-known that the presence of phosphate in heavy soil causes increased root development, but whether this applies also to slagged plots and the actual fate of the phosphates in this case, are points which still require investigation.

15 - **Results of Manuring with Superphosphate on the Yield and Quality of Indigo in India.** — See No. 50, of this *Review*.

16 - **Effect of Phosphate Fertilisers in Conjunction with Green Manures, upon Spring Cereals in India.** — See No. 50 of this *Review*.

17 - **Availability of Organic Nitrogenous Compounds.** — ROBINSON, C. S., WINTER, O. B., and MILLER, E. J. (Michigan Agricultural Experiment Station, East Lansing, Michigan), in *The Journal of Industrial and Engineering Chemistry*, Vol. XIII, No. 10, pp. 933-936, diagr. 1, New York, Oct. 1, 1921.

Several years ago investigations were started with the following objects: *a*) to ascertain the relation between the chemical constitution of organic nitrogenous substances and the availability of their nitrogen for plant nutrition; *b*) either to devise a new method or to improve the existing methods for measuring this availability. Both these questions are of importance because of the growing tendency to utilise all sorts of organic nitrogenous substances as fertilisers.

Amongst the various methods put forward for the determination of the availability of nitrogen as regards the said substances, two only, both of them developed rather empirically, have shown themselves of comparative value; *viz.* the alkaline permanganate and the neutral methods. In the present investigation the authors made determinations, employing the alkaline permanganate treatment, of the active insoluble nitrogen in a number of amino-acids and acid amides, typical organic compounds of known constitution in which the nitrogen was combined in several ways. After this, further investigations were made in a similar way, on the well-known proteins or substances containing them. Finally analyses were made of samples of commercial nitrogenous fertilisers employing the same method and the nitrogen partition method of VAN SLYKE. Data relative to these determinations are given as follows:

Per cent of Total Nitrogen of Fertilisers in Various Forms.

	Total nitrogen	Soluble nitrogen (ammoniacal and nitric) + active insoluble	Amide nitrogen	Amino nitrogen	Amide + amino nitrogen
Peat (dried)	2.76 %	40.21 %	20.65 %	39.14 %	59.79 %
Peat (wet)	3.49	42.40	13.46	39.53	52.99
Pulverised sheep manure	2.34	28.20	14.53	41.88	56.41
Hay and silage	3.10	16.71	6.13	42.22	48.35
Fruit and vegetables	3.74	43.85	5.09	49.20	54.29
Bone meal	2.18	46.43	4.84	49.20	54.04
Animal tankage	4.40	56.94	7.95	54.31	62.26
Pure bone meal	3.12	62.81	8.01	55.76	63.77
Castor bean cake	4.78	48.96	11.09	55.85	66.94
Cotton seed meal	6.73	50.51	10.33	58.09	68.42
Bone	3.05	67.21	5.24	60.98	66.22
Glue hair	8.49	64.55	5.89	66.77	72.66
Beef scraps	8.72	74.54	5.96	68.11	74.07
Hair waste	14.27	70.85	9.52	70.00	79.52
Dried blood	14.01	71.31	6.56	75.23	81.79
Mixed chrome uppers	9.88	51.22	4.76	60.32	65.08

Assuming that the ammonifying as distinguished from the aminofying or hydrolysing power of the alkaline permanganate solution is comparable with the action of soil agents, all amino nitrogen and a portion of the nitrogen present as acid amides may be said to be included. There is also another class of compounds termed the potentially available class, which may be converted into the former class. This includes a portion of the acid amides, the peptides which can be hydrolised to amino acids, and primary and secondary amides. The peptides probably constitute the great bulk of this class so far as ordinary fertiliser materials are concerned. This is the uncertain quantity in evaluating any material from the fertiliser standpoint. In some cases transformation into the available class is

so easy and complete that there can be no practical distinction between the two. In other cases however this process is so slow that the unavailable class is approached. Fundamentally, the problem of the determination of the availability of organic nitrogen compounds is the possibility of a proper estimation of the rate of ammonification of the members of this class. Up to the present the permanganate methods have proved the most satisfactory and the authors will publish later the results of their further studies.

18 - **The Influence of Certain Fertiliser Salts on the Growth and Nitrogen Content of Some Legumes.** — Mac Taggart, A. (Cornell University), in *Soil Science*, Vol. XI, No. 6, pp. 435-454, figs. 2, bibliography of 61 works. Baltimore, M. D., June 1921.

It has been fully demonstrated that calcium plays an important part in the soil in the symbiotic assimilation of nitrogen by legumes, but the activity of certain other fertilising elements has not been so fully shown. For this reason the author after a bibliographical survey of the literature on this subject, gives the results of a series of experiments made with 36 boxes filled with a soil mixture consisting largely of clean sand and about $^1/_7$ of sandy loam with slightly more than 0.5 % of calcium carbonate added to each box. The moisture content of the soil was maintained throughout at 10 % (on the dry-soil basis). Half of the boxes were filled with alfalfa and half with peas. The boxes were divided into 9 series of 4 and treated as follows: 1) control; 2) nitrogen (dried blood); 3) phosphorus (disodium phosphate); 4) potassium (muriate of potash); 5) sulphur (gypsum); 6) nitrogen, phosphorus, potash and sulphur in above forms; 7) nitrogen, phosphorus, and potash *idem*; 8) nitrogen, potash and sulphur; *idem*; 9) phosphorus, potash and sulphur, *idem*. Previous to sowing, all the boxes were inoculated with sand cultures. Following the crop of field peas, soy beans were sown, after suitable inoculation of the soil, application of calcium carbonate and fertiliser.

Of all the fertiliser elements applied, the phosphorus showed the most marked effect. Alone, it distinctly increased the dry matter and total nitrogen, and to a lesser extent the percentage of nitrogen in all 3 legumes; the order of average influence on the crop being: field peas, soybeans and alfalfa.

In combination with nitrogen, potassium, and sulphur, phosphorus markedly increased the dry matter and total nitrogen in peas, soybeans and alfalfa. However, it increased on the contrary the percentage of nitrogen in soybeans and alfalfa only slightly, and decreased the percentage in the case of peas.

Nitrogen as a single element can hardly be said to benefit the plants with respect to yields of either dry matter or nitrogen, except perhaps in the case of field peas. In combination with phosphorus, potassium and sulphur, nitrogen did not produce any lasting effect where it was employed alone; in fact, there was perhaps less response. It may be concluded also that nitrogen in combined form does not hinder nitrogen assimilation by legumes. Potassium used alone caused an increase in the total nitro-

gen and dry matter in field peas and alfalfa in the order named, but a decrease with respect to these factors in soybeans. Only in the percentage of nitrogen did potassium show an increase common to all 3 crops, in the order named above. Sulphur in the form of gypsum used alone or with other fertilisers somewhat increased the growth and nitrogen content of alfalfa, but does not appear to have had any effect on field peas and soybeans.

Taking into consideration the influence of the fertilisers employed for nitrification purposes or rather to assist in the nitrogen accumulation in the soil, the most marked effect generally was produced when phosphorus was applied, which resulted in the distinct development of the crops. Nitrogen applied alone increased soil nitrification after the harvesting of all three crops, particularly after alfalfa, but when applied in combination with other fertilising substances, it did not have this effect. Potassium, in the form of muriate of potash, apparently slightly inhibited nitrate-nitrogen accumulation; the sulphur, in the form of gypsum, increased nitrification subsequently in the soil. In general, there appeared to be a tendency toward correlation between the dry matter produced and the subsequent soil nitrification, due probably partly to the greater root system associated with increase in top growth, and hence to greater amounts of decayed roots, favourable to nitrification.

19 - **Carbonication of Plants By Combustion Gases.** — RIEDEL, F., in *Chemiker Zeitung*, Year XLV, No. 101, pp. 829-830. Cöthen, August 30, 1921.

After having disposed of the various objections raised in connection with the practical installation of plant for the carbonisation of crops in the open field by means of combustion gases, especially those from siderurgical works (1) the author gives figures showing the economic returns from the process. He calculates that for the carbonication of one hectare of land, 500 m. of cement pipes with a diameter of 10 cm. are required; the distance between the pipes being 25 m. The price of the pipes in March 1921, was 7.5 *marks* per metre; counting transport and laying, the cost would work out at 12 *marks* the metre which would make 6000 *marks* per hectare; by adding a similar sum for the cost of the chief gas pipe and various expenses, the total amount would be 12 000 *marks* per hectare or 1.2 *marks* per sq. metre.

Calculating the working expenses per square metre the following figures are obtained;

	Marks
20 % depreciation and interest	0.24
Cost of extra mineral fertiliser required	0.12
Repairs	0.08
Cost of extra labour necessitated by heavier crop	0.10
Marks	0.54

(1) See *R.* June 1920, No. 626. (*Ed.*)

If as a result of the carbonication, the potato crop is doubled; that is to say if it rises from 1.75 kg. to 3.50 kg., the net profit in the case of potatoes fetching 0.60 *marks* the kg., will amount to 0.51 *marks* per square metre or 42 %, and if early potatoes are grown, the profit is even higher. The prices quoted above are for installations that can use the discharge of gas motors which finds its way to the soil of its own accord; should ventilators for the expulsion of the gas be needed, this would mean an extra expense of some *pfennige*, but in any case there would be a good margin of profit.

As regards the larger water requirements of crops subjected to carbonication the author states, that the greater development in length of the plants' root systems enables them to make better use of the reserves of water in the soil. It may however be the case that in years of drought the full benefit of carbonication can only be obtained by the application of carbon dioxide.

AGRICULTURAL BOTANY, CHEMISTRY AND PHYSIOLOGY OF PLANTS

20 - **A Systematic Catalogue of the Plants Cultivated in Spain (Species and Varieties) and of the Principal Species of Trees.** — DANTÍN CERECEDA J., *Catálogo metódico de las plantas cultivadas (especies y variedades) en España y de las principales especies arbóreas*; *Servicio de publicaciones agrícolas de Ministerio de Fomento*, pp. 62, figs. 22. Madrid, 1920.

With this work of enumeration and identification which extends as far as possible even to varieties, the author begins his phytographical study of the plants cultivated in Spain. He does not pretend to have made a complete list, although many of the popular names he gives are recorded for the first time. In this catalogue, there are 422 species with their botanical names and the popular names by which they are known in the different Provinces of Spain. Then follows a table of 1000 popular names, and a bibliography of the 13 works most frequently consulted.

21 - **"Arroz brabo", Wild Rice in the Interior of Brazil.** — *A Lavoura*, year XXV, Nos. 8-9, pp. 219. Rio de Janeiro, September 1921.

In the State of Goyaz and in the inundation zone of the Araguaya, there are large quantities of a wild cereal much resembling rice, and known in the country by the name of "arroz brabo" (wild rice).

This plant only differs from common rice in having looser panicles and more brittle seeds.

In the neighbourhood of the river Jaoahé, "Arroz brabo" is used with much success in fattening stock.

22 - **Composition of Californian Citrus Fruits.** — CHACE, E. M., (Chemist in Charge), WILSON, C. S. and CHURCH, C. G. (Assistant Chemists, Laboratory of Fruit and Vegetable Chemistry), in *United States Department of Agriculture, Bulletin No.* 933. Contribution from the Bureau of Chemistry, pp. 1-18, figs. 4, bibliography of 5 works. Washington, Oct. 18, 1921.

From 1887, when 12 cartloads of citrus fruits were exported from California, until 1919-20, when 12 000 were exported, the cultivation of Californian fruits has been very widely extended. The varieties grown to the largest extent at present owing to their suitability to Californian conditions, are "Eureka", native of California raised from Si-

cilian citrons, and the " Lisbona ", widely spread and imported directly from Australia. The authors have analysed the fruits of these two varieties and also of a third, *viz.* " Villa Franca ", at the present time not grown. It is considered advisable that the grower should be kept acquainted with the data relative to the composition of the fruits no less than the manufacturing establishments directly connected with the products, such as oils and citric acid.

The results obtained indicate the comparatively negligible differences existing between the various characters of the varieties studied. The most outstanding are those with reference to the specific weight of the fruits; the Eureka seems to stand at the top and the two others were practically identical. As regards the essential oil content, the var. " Villa Franca " showed the highest percentage, whilst " Eureka " gave a somewhat lower percentage. Although no difference was noticed in the citric acid content, there was a marked difference in the sugar percentage between the Eureka and " Lisbona " varieties.

Acidity attains its maximum at the beginning of autumn; the maximum specific weight is reached towards midsummer, and the minimum during winter. The minimum essential oil content was found to be at the end of winter and in the spring, and the maximum in the autumn.

No correlation was observed between the colour of the bark, its thickness and the composition of the fruits, but the specific weight and the acid content became less with the thickening of the bark. No difference was observed between fruits obtained on the sea coast and those from inland.

23 - **A Study of Nitrogen and Root Space as Factors Limiting the Yield of Maize in Egypt.** — PRESCOTT, J. A., in *Sultanic Agricultural Society, Technical Section*, Bulletin No. 4, pp. 1-14, figs. 6. Cairo, 1920.

The response of the maize crop to nitrate of soda has been shown as the result of field experiments conducted by the Sultanic Agricultural Society at Bahtim, to follow very closely the mathematical expression of MITSCHERLICH relating to the Law of the Limiting Factor (*Landw. Jahrb.* XXXVIII, 1909, p. 537; *Landw. Versuchs. Stat.*, LXXV, 1911, p. 231; LXXVIII, 1912, p. 127).

The dressing of nitrate of soda usually recommended in Egyptian farming is 150 kg. per feddan (1 feddan = 1.038 acre), but 200 kg. is frequently employed as a standard of comparison. In this experiment it was found that up to 300 kg. there was a steady increase in yield of crop, but if 400 kg. was applied, there was a smaller yield. Whether this diminution is due to the harmful effects of excess of nitrogen or of excess of sodium salts remains yet to be ascertained and the author proposes the repetition of the experiment, using ammonium nitrate instead of sodium nitrate.

It is frequently the case that the use of large quantities of nitrogenous manures retards the maturation of the crop; in the Bahtim experiments, however, no retardation has been observed.

The author includes data relative to harvest, effect of increasing dressing of sodium nitrate, etc.

Root Space as the Limiting Factor. — The spacings adopted varied rom 25 cm. up to 95 cm. The original plots were each $^1/_{10}$ feddan and were ubsequently divided into two parts, the northern half receiving nitrate f soda at the rate of 150 kg. per feddan and the southern half being left nmanured :

In both the manured and unmanured series the mathematical xpression of MITSCHERLICH can be applied with fair agreement.

The yield per feddan, according to the given curves, can be related o the number of plants per feddan, giving a maximum yield at the spacing f about 16 000 plants per feddan (nitrate series) and of 10 000 plants per eddan (unmanured series). It is significant that the local method of plant-ng gives an intensity of about 12 000. However, within fairly wide li-nits, the yield does not appear to vary very much and it seems probable hat the maximum crop would be between 12 000 and 20 000 in the itrate series and between 8 000 and 14 000 in the unmanured series.

During the growth of the plant, weekly observations were made on he heights of the unmanured plants, the measurements being made to he tip of the longest leaf and later to the end of the tassel ; curves are here iven for the recorded heights. The plants in all the spacings grew togeth-r for the first 15 days after which there was a successive breaking away; : is thus possible to trace the course of the lateral root development and nterference during the course of the season. The following data indicate his development during the growth period (diameter in cm.) for 5 uccessive fortnightly periods, *viz.* 25, 35, 45, 65, 85.

The author includes data relative to harvest as a result of sodium itrate treatment and also for the spacing experiments, and curves, etc. howing the effects produced in every case.

4 - **Observations on the Growth of Maize in Egypt.** — PRESCOTT, J. A., in *Sultanic Agricultural Society, Technical Section, Bulletin* No. 7, pp. 1-25, figs. 10, tables 11, Cairo, 1921.

During the seasons 1918 and 1919 observations were made in 3 differ-nt ways on the growth of maize.

I. AUTOMATIC RECORDS OF GROWTH RATE. — The curves given in-licate that there are two maxima during the 24 hours ; at no time does the naize plant stop growing altogether but at daybreak there is usually a light decrease in the height probably associated with the opening of the tomata and the loss of water due to the resumption of day time transpira-ion. This is followed by a rapidly increasing rate of growth until the notter part of the day is reached when a slight retardation is observed ; n the late afternoon there is again an acceleration giving a new maximum bout sunset. During the night the growth rate falls off gradually to he minimum just before sunrise. A retardation of growth rate due to he soil water factor is shown in all the curves though only to a slight xtent. Measurements made in 1918 by MOSSÉRI in his garden at Giza how the growth of plants during 12-hour periods of day and night, and t appears that growth in the night hours from 8 p. m. to 8. a. m. tends to

be greater than in the day time 12 hours period, doubtless owing to the check during the hotter part of the day.

II. DAILY MEASUREMENTS OF GROWTH RATE ON SELECTED MAIZE PLANTS. — The temperature and humidity records were taken from the mean data for Abbassia and Giza supplied by the Physical Service of the Ministry of Public Works. The curves for the 3 day means are given. The main features brought out are in the first place the effect of irrigation on growth (after each watering there is a marked increase in growth rate); this is shown particularly well in the 1919 curves where the soil moistures are given. There is also a fairly close relationship between the temperature and growth rate in the early part of the season, when soil moisture is abundant. This relationship becomes less noticeable as the plant becomes more developed and the soil moisture conditions intervene.

In 1919, an experiment was planned in which soil moisture determinations were made every 2 or 3 days so that as soon as the water content, (depth 20 to 40 cm.) approached 25 % of the dry soil, irrigation was possible. It was found necessary to irrigate more frequently than usual and a slight benefit was obtained in the final yield. Later experiments indicated that with heavy manuring the effect of the water factor on the yield became more marked. The adjoining table indicates that frequent irrigation as controlled by soil moisture gave a yield (stalks and ears respectively) of 4760 kg. and 1510 kg. per feddan, and the yield with normal irrigation (7 times between July 7 and October 22) of 4630 kg., and 1460 kg. There was also an increase in the heights of plants when irrigations were more frequent *e. g.* frequent irrigation, mean height of 40 plants 1) to leaf tip, (18 to 46 days), 55 to 210 cm.; normal, 55 to 202 cm.; 2) to tassel (46 to 67 days), — frequent, 158 to 274 cm.; normal, 151 to 266 cm.

III. WEEKLY MEASUREMENTS AS RESULT OF SOWING EXPERIMENTS. — The normal time for planting maize in Egypt is towards the end of July. In 1919, however, sowings were made from the beginning of April until the end of September and weekly observations were made of the growth and development of the plants throughout the season. The variety employed was the Bahtim "Surecropper", long season semi-dent variety.

Growth and development curves are given for the various sowing dates; these correspond with the figures given. The physiological development of the plants shows the same characteristics in the curves of leaf development, tasselling, silking and maturation. These features are also brought out according to the isophytic diagram. The best growing conditions for the maize plant in Egypt are evidently to be found late in July and during the month of August. The amount of growth, including time for germination in the first 21 days after planting, shows how far temperature plays a part in determining the rate of development of the maize plants. Germination in the case of the April sowing took place in 12 days, in the May sowing it was 10 days, while in July sowings the time is normally 5 or 6 days. Although the mean temperature at the end of August is about the same as early in June, the night temperatures are more favourable than at the earlier period. The following table shows the comparative

yields of maize sown at different periods and the heights at 21 days after planting.

Date of sowing	Comparative yield * of grain	Height of plant	Temperatures (°C.) Average for 21 days		
			Maximum	Minimum	Mean
April 1	56	24.6 cm	29.6	11.4	20.5
May 1	63	25.1	30.4	12.2	21.3
June 1	84	43.5	33.7	14.8	24.2
June 15	88	51.7	34.7	16.2	25.4
June 29	92	61.6	36.8	17.4	27.1
July 13	100	69.1	36.3	18.7	27.5
July 27	96	62.2	35.5	18.5	27.0
August 10	86	59.1	35.7	18.5	27.1
August 24	—	62.8	33.3	17.1	25.2
September 7	64	51.9	31.7	15.4	23.5
September 21	39	—	—	—	—

(*) Maximum yield in sowing of July 12 being taken as 100.

From a consideration of the mean weekly maximum and minimum temperatures at Bahtim (April to November), it seems clear that the optimum growing weather in Egypt for maize occurs during the month of August; at this time night temperatures are higher than at any other time of the year and during the day time the effects of water strain on the plants is likely to be much less in evidence than during the month of July.

25 - **The "Pure Line" and the "Pure Chain": a Contribution to the Terminology of Genetics.** — PRELL, G., in *Zeitschrift für induktive Abstammungs und Vererbungslehre* Vol. XXVI, Parts 3-4, pp. 287-294. Leipzig, July 1921. PLANT BREEDING

The term "pure line", in the sense in which it is used by JOHANNSEN, should be employed exclusively for groups of individuals derived from an autogamous stock by means of repeated self-crossing. It is however often used also to designate groups of genetically isolated individuals derived from two allogamous parents. The necessity of finding a distinct and suitable term for this second class of individuals has long been felt and the author proposes the expression, "pure chain", ("reine Kette").

Thus we have:

Pure Line. — The entire group of individuals descended from a single autogamous, homozygous stock.

Pure Chain. — The entire group of individuals descended from two allogamous stocks which are isogeneous (isozygotes and homozygotes), only as regards sex and the characters with which they are possibly connected (heterozygotes only as far as sex is concerned).

The two groups differ in the number of diplonts (diploid numbers of chromosomes) necessary to their formation and in the nature of the

relations existing between the haplonts (haploid numbers of chromosomes), that unite to form the diplont. In pure lines, the point of departure is a single diplont, and the whole genealogical tree can correctly be represented as a simple *line*. On the other hand, the pure chain starts from two diplonts, so that in the genealogical development, there are two diplont forms that constantly coalesce and separate according to the same rule, thus producing the exact image of a *chain*.

The haplonts of a pure line are identical, from the genetic and typical standpoint, whereas the haplonts of the chain differ in the factor or group of factors of sex. The contrast between the line and the chain is specially noticeable when there are other morphological factors united to those of sex ; in this case, the heterozygotism of a diplont is accentuated.

26 – **Study of Barley Hybrids, Especially from the Standpoint of Fixity of the Segregation of Characters in the F_2.** — BLARINGHEM, L., in *Annales de la Science agronomique*, Year 38, Series 6, No. 4, pp. 177-230. Paris, August 1921.

The visible morphological characters of barley grain are indices which allow varieties suitable for the brewery to be distinguished from those suitable for cropping. These characters are regularly transmitted in a large number of lines and can be used as a test of the botanical purity of each kind.

The author gives the results of a series of experiments relating to two characters 1) hairs on axis of spikelet : *stiff* **(A)**, or *downy* **(a)** ; 2) lateral dorsal veins of the seed : *rough* **(B)**, or *smooth* **(b)**. These two pairs of characters behave as independent Mendelian units in crosses between pure form of the variety *Hordeum distichum nutans*.

HAIRS ON AXIS OF SPIKELET. — The pair **Aa** obeys the Mendelian law in 29 crosses (with 110 F_1 hybrids and 5422 F_2 hybrids), between varieties belonging to the Linnaean species, *Hordeum distichum*, *H. nudum* and *H. tetrastichum*. In every case and in all the combinations, the ratio of stiff-haired to downy-haired individuals in the F_2 was as 3 : 1. This cha-

TABLE I. — *Segregation in the* F_2 *Generation of Crosses between Forms of H. distichum nutans.*

Crosses	Total number of F_2 plants	Plants with	
		Stiff hairs	Downy hairs
0.185 ♀ × 0.431 ♂	39	32	7
0.236 ♀ × 0.431 ♂	343 (344)	262 (258)	81 (86)
0.385 ♀ × 0.190 ♂	27	21	6
0.431 ♀ × 0.185 ♂	36	26	10
0.431 ♀ × 0.185 ♂	23	15	8
0.431 ♀ × 0.236 ♂	406 (408)	304 (306)	102 (102)
Totals . . .	874 (880)	660 (660)	214 (220)

racter therefore manifests itself independently of the nature of the above-mentioned 3 species upon which it is possible by means of suitable crossings to impress at will the character of stiff hairs or downy hairs respectively.

It remains to be seen whether these characters are of any importance from the industrial, agricultural or commercial standpoints.

The same numerical relations are found in the crosses: *H. distichum nutans* × *H. distichum erectum*, *H. distichum* × *H. nudum* and *H. distichum* × *H. tetrastichum*.

TABLE II. — *Segregation in the* F_2 *of Crosses between Forms of H. distichum nutans* (1909).

Crosses	Total number of F_2 plants	Plants with rough veins	Plants with smooth veins
Bohemia ♀ × 0.236 ♂	524 (**520**)	392 (**390**)	132 (**130**)
0.236 ♀ × Bohemia ♂	629 (**640**)	481 (**480**)	148 (**160**)
0.185 ♀ × 0.236 ♂	47	36	11
0.185 ♀ × 0.431 ♂	39	29	10
0.431 ♀ × 0.185 ♂	36	33	5
0.431 ♀ × 0.185 ♂	24	15	8
Totals . . .	1298 (**1300**)	986 (**975**)	312 (**325**)

DORSAL VEINS. — The pair **Bb** on the other hand behaves somewhat differently from the pair **Aa**. These characters are only independent in the variety *Hordeum distichum nutans* (which includes all the best brewing barleys), and solely in the 1906 crosses. In the F_2, individuals with rough veins and smooth veins occur in the ratio 3 : 1.

On the other hand much segregation is already found in the crosses made in 1907 (all between forms of *H. distichum nutans*) as is shown in Table III

Similar cases of segregation occurred in 1908; the author suggests, that they may be explained by the greater plasticity of Chevalier II, Hannchen, and the lines **0.190, 0.385** and **0.219** as compared with the lines **0.236, 0.431** and the form Bohemia. If this is the case the pair of characters *presence — absence of bristles* would be a more significant association in proving the fixity of the lines than the pair *stiff hairs — downy hairs*. This seems to be proved by the behaviour of the hybrids arising from crosses between **0.501** (line of *H. distichum erectum* with smooth veins), and **0.631** (line of *H. distichum erectum* with rough veins). In fact, in the F_2 of crosses made in 1906, in the neighbourhood of Paris, the ratio of bristly individuals to smooth individuals was not as 3 : 1, but as 1 : 1, as if the lines **0.501** and **0.631** were fixed hybrids. In the crosses effected in 1906 out of the 91 (92) individuals of the F_2, 42 had rough and 49 had

TABLE III. — *Segregation in the* F_2 *Generation of Crosses Between Forms of H. distichum nutans* (1907).

Crosses	Total number of F_2 plants	Plants with rough veins	Plants with smooth veins
0.190 ♀ × 0.236 ♂	550 (552)	463 (414)	87 (138)
0.431 ♀ × 0.385 ♂	100 (100)	79 (75)	21 (25)
Totals . . .	650 (652)	542 (489)	108 (163)
0.109 ♀ × Chevalier II ♂	48	30	18
0.219 ♀ × Hannchen ♂	27	16	11
0.219 ♀ × Bohemia ♂	115	69	46
Totals . . .	100 (192)	115 (144)	75 (48)

smooth veins, instead of 69 and 23, as there should have been theoretically according to the ratio 3 : 1.

The crosses made in 1907 between the same lines, **0.631** and **0.521**, gave on the contrary different results ; in F_2, the general ratio was 3 : 1 but there were individual variations, such as had not been observed among the former hybrids. Similar results were again produced in the case of cross **0.190** × **0.631** (and **0.631** × **0.190**) : the progeny in the F_2 dividing into 3 groups with very different ratios of segregation.

1st group = 3 : 1
2nd » = 1 : 1
3rd » = 9 : 7 or 15 : 1

The difference in the results observed from one year to another deserves notice, as it always occurred in the same types. The essential factor of genetic instability is to be found in line **0.631** (and perhaps also to some extent in **0.190**), but the author maintains that it is owing to the genetic instability of these types that the environment, and more especially the climate are able to alter the percentages (ratios).

This instability would manifest itself in the following manner in the crosses : supposing that **0.631** has a hybrid origin as regards the presence or absence of bristles, and that A (presence), is constantly dominant over **a** (absence). In this case, the uniformity and homogeneity characteristic of **0.631** would depend upon the condition that all the egg-cells with the character A were fertilised by **a** pollen, and reciprocally that all the **a** egg-cells were fertilised by pollen A. Crossing the heterozygous line **0.631 (Aa)** with the homozygous line **0.190 (aa)** gives the following combinations :

I { pollen. . . **A** **a** ; ovule. . . **a** **a** } or II { pollen. . . **a** **a** ; ovule. . . **A** **a** }

which gives **Aa**, **aA** hybrids (with bristles), and **aa** **aa** hybrids (smooth) in the proportion of 1 : 1, just as was found in the progeny of the 1906 hybrids and in the 1908 group, *Cistercienne* × *Bohemia*.

This proportion was found in half the cases examined.

The great homogeneity observed in **0.631** is due to prolonged selection under determined (climatic) conditions of environment. Now it is quite possible that the same conditions of growth would act upon **0.631** × **0.190** in a manner quite different from that in which they would act upon **0.631**, and that the regular fertilisation of all the **0.631 A** ovules with **a** pollen (and reciprocally), would undergo some modifications (in the cross **0.631** × **0.190**). Once the equilibrium is disturbed, the segregation ratios become irregular and vary from one year to another according to the variations of the environment that in any way effect the state of equilibrium.

It still remains to be demonstrated whether under given conditions of climate, soil, date of sowing, cultural operations, etc. **0.631** degenerates, in a more or less irregular manner as regards the character of bristles.

Breeding experiments alone can answer this question, and so far, none have been carried out.

It is however well to remember that *Svanhals* and *Primus* barleys, of which the genetic constitution is heterozygous, are fixed in Sweden and Germany, but rapidly degenerate (as regards this very character of bristles), when they are cultivated in dry years in Picardy and in Eure-et-Loir (France).

27 - **Studies in Linkage Relations in Maize made in the United States.** — EYSTER, W. H., in *Genetics*, Vol. 6, No. 3, pp. 209-240, tables 32, bibliography of 20 works. Baltimore, May 1921.

Results of a systematic search for linkages in maize, especially as regards the two characters tunicate ears (in which the glumes of the ear develop to such an extent that each kernel is entirely enclosed), and sugary endosperm, both dependent on the factor pairs represented as **Tu tu** and **Su su**. In previous tests the author obtained a certain number of reciprocal crosses between the tunicated and sugar heterozygotes (**Tu tu Su su**) and plants non-truncated with non-sugary endosperm (**Tu tu Su su**). The results are shown in Table I. It was estimated that groups **Su Tu**, **Su tu**, **u tu** would be equal. On the contrary however in every case there was an excess of **Su Tu** and **su tu** respectively over **Su tu** and **su Tu**. The tendency of these factors (**Su** and **Tu**) to remain together in inheritance can be explained by assuming that they are located in the same chromosome. But should this follow a fixed rule, the groups **Su tu** and **su Tu** should be missing. Admitting however the undeniable existence of the linkage between **Su** and **Tu**, the resulting exceptions may be explained by the crossing-over theory (1) viz. a certain number of chromosomes are located between the *locus* of **Su** and the *locus* of **Tu**; the chromosomes of the non-tunicated and non-sugary

(1) See *R.* Jan. 1918, No. 29, note (1) p. 54. (*Ed.*)

plant are located in a similar fashion and the result is an exchange between homologous segments which become united to form new chromosomes; these should possess one only of the two characters previously linked together. The more this phenomenon is intensified and frequent, the more often will **Su tu** and **su Tu** be represented. In the case in question, the percentage of crossing over in the two groups of crosses, should amount to 26.94 and 38.85 % respectively.

The rate of crossing-over can neither be designated, fixed or constant; it is readily influenced by prevailing conditions and by genetical factors supplied by the chromosomes.

In megasporogenesis (connected with the formation of egg-cells) the percentage of crossing-over in the case investigated, amounted to 21.1 and 30.5 %, while in microsporogenesis (connected with pollen grains), the average is higher than 8 %.

In a second series of genetical experiments the author has made a special study (using a certain number of selected crosses) of the relations between **Tu** and **Su** and other mutant factors:

C = colour of aleurone
Sh = shrunken endosperm
I = factor opposing the production of colour of aleurone
G = factor for golden plant
R = red aleurone
B = brown colour of plant
Lg = leaves without ligules
P = coloured pericarp
Pl = purple anthers
A = anthocyanin pigmentation in leaves, and grain
An = semi-dwarf plants with anthers on the ears
Bl = brown blotches on leaves
Cr = crinkled leaves
D = dwarf plant
F = fine striping in the leaves.
Fl = floury endosperm
J = *Japonica* striping of leaves
Pr = purple aleurone in the presence of other aleurone factor pairs
Ra = *ramosa* ear
Gs = green striping of leaves
V = greenish-white seedling
W = white seedling
Y = factor concerned in the formation of yellow endosperm

The following data refer to the factor **C** (colour of aleurone). In the cross **Tu tu Cc** × **tu tu cc**, the progeny **Su Tu**, **Su tu**, and **su Tu su tu** are obtained in equal proportions (see Table II), which indicates that **C** is found in a chromosome different from that associated with **Tu** and **Su**. Similar conditions appear to exist in the following cases:

TABLE I. — *Linkage between* **Tu** *and* **Su** *and intensity of the phenomenon «crossing over».*

Pedigree	Su tu	Su tu	su Tu	su tu	Percentage of «crossing-over»
Tu tu Su su × tu tu su su					
196 – 10 × 192 – 4	89	19	31	98	21.10%
198 – 9 × 192 – 3	147	57	63	127	30.46
140 – 4 × E 7595 – 11 . . .	90	35	24	70	26.94
Totals . . .	**326**	**111**	**118**	**295**	**26.94%**
tu tu su su × Tu tu Su su					
E 7595 – 11 × 140 – 4	26	8	19	25	34.62%
E 8575 – 4 × 201 – 7	78	56	32	86	34.92
Totals . . .	**104**	**64**	**51**	**111**	**34.85%**

TABLE II. — *Cross* **Tu tu Cc × tu tu cc.**

Pedigree	Su Tu	Su tu	su Tu	su tu
362 – 365	31	32	36	36
366 – 367	67	64	83	84
368 – 369	53	53	54	58
370 – 371	54	68	60	69
Totals . . .	**205**	**217**	**233**	**247**

28 - **Type and Variability in Kafir *(Andropogon Sorghum).*** — CONNER, A. B., and KARPER, R. E., in *Texas Agricultural Experiment Station, Agricultural and Mechanical College of Texas, Division of Agronomy, Bulletin* No. 279, pp. 1-14, figs. 6. Brazos County, Texas, April 1921.

The object of this study is to present data as to type and variability of certain characters in *Andropogon Sorghum* resulting from statistical research. The data given are taken from material accumulated from 1915 onwards, involving the measurement of material from crib-run heads and selected population material and from lines successively inbred for single characters. This work was conducted at Texas Agricultural Experiment Station, Substation No. 8, near Lubbock, Texas, a region well adapted to the cultivation of sorghum.

In 1916, 669 crib-run standard blackhull kafir heads were measured and records were made as to:

1) Number of seed-bearing branches ; 2) Length of seed bearing branches ; 3) Number of nodes per head ; 4) Length of rachis or centre stem ; 5) Length of head ; 6) Weight of head ; 7) Weight of threshed grain. In succeeding work with progeny the following additional measurements were taken : 8) Height of plant ; 9) Diameter of plant ; 10) Number of nodes per plant ; 11) Weight of green forage.

The bulletin in question deals however with the first 4 features only. Eighty individual heads were selected for planting in 1917, comprising 8 groups, each group representing one of the extremes of the 4 pairs of characters involved. The selection for the 1918 planting, within a single group, included 10 heads taken from the single row in that group whose progeny conformed to the highest standard for the particular character for which selection was made. Accordingly the selections were made in each generation for a 4-year period. The method of selection adopted is clearly shown in the accompanying diagram. The tabulation of the data for population and for lines inbred for 4 generations is given in the form of tables and graphs, which show the type and variability existing in each population and line from year to year. The tables of statistical constants seem to be quite reliable, judging from the probable error in each case.

The 8 lines involved in every case showed uniformity and purity in the F_2 generation. This is in accordance with the low percentage of cross pollination found by the authors in open-pollinated heads. The practical significance of this fact is two-fold : 1) It lends greater reliability to preliminary uncontrolled breeding work ; 2) It emphasises the value of the head-row method of breeding grain sorghums and gives a greater probability of obtaining pure lines.

The fact that marked progress was made in one only of the 8 lines involved, *viz.* the line selected for few seed bearing branches, emphasises the importance and value of selecting a large number of heads for the initial planting to increase the chances of including superior individuals.

The variability in the several lines, as shown in the tables, is less than in the populations, and is consistently uniform in the F_2 and succeeding generations, further emphasising the purity of the lines in the F_2 generation.

29 - **The Interesting Relation between the Appearance of the Globe Mutant in *Datura Stramonium* and the Behaviour of the Chromosomes.** — BLAKESLEE, A. F., in *Genetics*, Vol. 6, No. 3, pp. 241-264. Baltimore, May 1921.

The " Globe " mutant in *Datura Stramonium* is characterised by depressed-globose capsules, by decreased vigour in growth and by the broad and only slightly toothed leaves.

In the *Datura*, the placing and behaviour of the chromosomes are closely associated in relation to the appearance of this mutation and to several others. Consequently there has been noted, in every case, a duplication of chromosomes giving rise to dimorphic gametes with 12 and 13 chromosomes instead of a single normal type with 12. These are called simple trisomic mutants ; in somatic cells one of the 12 sets is a trisome with three homologous chromosomes instead of the normal two.

1) When selfed, the mutant character is passed on to about 22 % of the descendants.

When crossed with a normal as the male parent, the mutant character is transmitted to about 26 % of the progeny. If however the pollen of a mutant is employed, the abnormal character is apparent in only about 2 % of the progeny.

The author has concluded therefore :

a) As a general rule, the mutant complex is transmitted through the egg cells and either not at all or only to a very limited extent through the pollen.

b) By crossing the mutant (♀) with the normal (♂), the number of mutants obtained in the progeny was inferior to that expected, which may be attributed to the lessened vitality of the mutant forms. Selfing continued for 10 generations has not increased the proportion of mutants in the progeny.

2) New Globe mutations under normal conditions have occurred in about 0.05 % of the descendants (1 out of 2000 individuals). The percentage is, however, distinctly higher, in cases which already contain the simple trisomic mutants. It is also higher when the mutant is used as the female parent, but when crossed with normals, there is no increased percentage of mutants in the progeny. It may be concluded therefore that new Globe mutations are caused by changes in the formation of the egg cells and rarely by changes in the pollen.

3) Normal plants show about 2.7 % of defective pollen grains; Globes about 8 %. The pollen sterility is then a characteristic of the Globe, as it is of the other simple trisomic mutants.

30 - **Number of Chromosomes in Various Species of *Lactuca* (1).** — MITSUHARU ISHIKAWA, in *The Botanical Magazine*, Vol. XXXV, p. 130. Tokyo, July 1921.

The author has made a special study of the number, behaviour and size of 15 species and 5 varieties of *Lactuca*, several of which are found growing wild in Japan; the figures in brackets indicate the number of chromosomes.

L. laciniata	(9)	*L. chelidonifolia*	(5)
L. Raddiana	(9)	*L. debilis*	(24)
L. triangulata	(9)	*L. stoloniifera*	(8)
L. Scariola var. *sativa*	(9)	*L. repens*	(8)
L. villosa	(9)	*L. Matsumurae*	(8)
L. Keiskeana	(5)	*L. yamagawensis*	(8)
L. lanceolata	(5)	*L. chinensis*	(16)
L. lanceolata var. *platyphylla*	(5)	*L. dentata* var. *genuina*	(12)
L. denticulata	(5)	*L. dentata* var. *albiflora*	(12)
L. denticulata var. *pinnatipartita*	(5)	*L. dentata* var. *alpicola*	(7)

As regards size and shape and number of chromosomes, 5 groups were distinguished, showing differences also of a general taxonomic nature.

(1) See *R. Feb.* 1918, No. 180. (*Ed.*)

NAKAI has previously stated, taking as a base the morphological characteristics, that the Japanese species of *Lactuca* may be classified under 4 headings, *Lactuca, Crepidiastrum, Paraixeris* and *Ixeris*.

It is of interest to note that the two classifications, made according to the two different standpoints (taxonomic and cytologic) are in agreement. *Lactuca* corresponds to group 1, *Crepidiastrium* to group 2, *Paraixeris* to group 3, and *Ixeris* to group 4 and to a fifth group constituted by the author (1).

31 - **The "Akala" (*Rubus Macraei* Gray), an Endemic Hawaiian Raspberry and the Possibilities of its Improvement by Hybridisation and Selection.** — ROCK, J. F., in *Journal of Heredity*, Vol. XII, No. 4, pp. 147-150, figs. 3, Washington, April 1921.

The Akala berry grows wild in Hawaii and possesses varying characteristics, which permit a subdivision into several distinct varieties.

In Kanaï, it is an upright spineless shrub, only a few feet in height, with somewhat small, dry berries.

In Maui the plants resemble to a certain extent the typical species from Hawaii, but have more spines and the fruits are less than half the size.

Rubus Macraei prefers the slopes of the high mountains of Hawaii proper (on Hualalaï, Mauna Loa and Mauna Kea). The largest fruited specimens were discovered by the author in a volcanic cone, known as Hinakapanulla, situated 6000 ft. high, in a desert lava field. The Akala was found in abundance with *Acacia Koahawaiiansis, Coprosma pubens, Styphelia tameiameiae*, and presented the appearance of a huge liana several feet long and with a woody stem 2 inches in diameter. The berries, of a dark rich purple colour were at least 2 inches in diameter. The plant is completely devoid of spines.

In the fern forests near the volcano of Kilanca there occurs another form of *Rubus Macraei*, also spineless, at least in older plants. This region has been given over to cattle grazing, and consequently the akala has gradually disappeared as a terrestrial plant and only the plants which became epiphytic have survived. These grow in the crevices of trunks and branches of trees and in the forks of moss covered trees. Although smaller than the berries found on the Hualaleï and Mauna Kea Islands, they are always over 1 ½ inches in diameter in spite of the lack of humus and of real soil.

(1) The unit characters to which may be applied or to which there is a tendency to apply Mendelian laws are regulated by the genetic factors in the chromosomes. Recently, the researches made in Japan and the United States (MORGAN etc.) have thrown considerable light on the question of chromosomes in the hereditary sense, and it has been concluded that a parallelism and intimate connection exist between the unit characters of the plant and the behaviour, number and forms of the chromosomes. The characteristics on the one hand and on the other, the chromatic constant which corresponds, constitute the two extreme points of the genetical inquiry. If much has been said and written hitherto concerning the characters, nothing really definite has been arrived at which confirms cytologically the Mendelian principles. It is therefore advisable to keep the plant breeding section well informed as to the most recent investigations on this subject. (*Ed.*)